ENVIRONMENTAL WATER ACCOUNT

DRAFT ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT

APPENDIX G

Water Quality Technical Appendix

Appendix G
Water Quality Technical Appendix

The Water Quality Technical Appendix supplements Chapter 5 Water Quality in the Environmental Water Account (EWA) Draft EIS/EIR. The sections below provide detailed information about constituents of concern listed in the Clean Water Act and beneficial uses of California waters defined in the California Water Code. The following sections discuss water quality in the San Joaquin-Sacramento Delta, and general water quality characteristics of reservoirs. The appendix ends with a detailed description of water quality effects in the Upstream from the Delta Region under the Flexible Purchase Alternative.

1.1 Constituents of Concern of 303(d) Listed Waterbodies

1.1.1 Cadmium

Cadmium is an element that occurs naturally in the earth's crust. Pure cadmium is a soft, silver-white metal; however cadmium is not usually found in the environment as a metal. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide). These compounds are solids that may dissolve in water but do not evaporate or disappear from the environment. All soils and rocks, including coal and mineral fertilizers, have some cadmium in them. Cadmium is often found as part of small particles present in air. Most cadmium used in this country is extracted during the production of other metals such as zinc, lead, or copper. Cadmium has many uses in industry and consumer products, mainly batteries, pigments, metal coatings, and plastics (ATSDR 1999a).

Cadmium enters air from mining, industry, and burning coal and household wastes. Particles can travel long distances in the air before falling to the ground or water. Cadmium can also enter water and soil from waste disposal and spills or leaks at hazardous waste sites. Fish, plants, and animals take up cadmium from the environment. Cadmium stays in the body a very long time and can build up from many years of exposure to low levels. Exposure to cadmium can occur through breathing contaminated workplace air (battery manufacturing, metal soldering or welding); eating foods containing it; low levels in all foods (highest in shellfish, liver, and kidney meats); breathing cadmium in cigarette smoke (doubles the average daily intake); drinking contaminated water; and breathing contaminated air near the burning of fossil fuels or municipal waste.

Breathing high levels of cadmium severely damages the lungs and can cause death. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones. Animals given cadmium in food or water had high blood pressure, iron-poor blood, liver disease, and nerve or brain damage. Federal agencies have made several recommendations to protect human health, including:

- The EPA has set a limit of 5 parts of cadmium per billion parts of drinking water (5 ppb). The EPA doesn't allow cadmium in pesticides (ATSDR 1999a).
- The FDA limits the amount of cadmium in food colors to 15 parts per million (15 ppm) (ATSDR 1999a).
- The OSHA limits workplace air to 100 micrograms cadmium per cubic meter (100 $\mu g/m^3$) as cadmium fumes and 200 μg cadmium/m^3 as cadmium dust (ATSDR 1999a).

1.1.2 Chlorpyrifos

Chlorpyrifos is an insecticide that is a white crystal-like solid with a strong odor. It does not mix well with water, so it is usually mixed with oily liquids before it is applied to crops or animals. It may also be applied to crops in a capsule form. Chlorpyrifos has been widely used in homes and on farms. In the home, it is used to control cockroaches, fleas, and termites; it is also used in some pet flea and tick collars. On the farm, it is used to control ticks on cattle and as a spray to control crop pests (ATSDR 1997).

Chlorpyrifos enters the environment through direct application to crops, lawns, houses and other buildings. It may also enter the environment through volatilization, spills, and the disposal of chlorpyrifos waste. Chlorpyrifos sticks tightly to soil particles. As it does not mix well with water, it rarely enters local water systems. Once in the environment, it is broken down by sunlight, bacteria, or other chemical processes. Exposure to chlorpyrifos occurs when using it to control household pests such as termites, fleas or cockroaches; breathing air outside of homes or other buildings where chlorpyrifos was applied to the ground around the foundation to control termites; breathing air in a field where chlorpyrifos was sprayed on to crops; and, touching soil or crops in a field where it was sprayed or touching freshly sprayed areas in a house.

Breathing the air in an area in which chlorpyrifos has recently been sprayed may produce a variety of effects on the nervous system including headaches, blurred vision, watering of the eyes (called lacrimation), excessive salivation, runny nose, dizziness, confusion, muscle weakness or tremors, nausea, diarrhea, and sudden changes in heart rate. The effect depends on the amount in the air and length of time exposed. Federal agencies have made several recommendations to protect human health, including:

- The EPA requires that spills or accidental releases into the environment of 1 pound or more of chlorpyrifos be reported to the EPA (ATSDR 1997).

- The EPA also recommends that children not drink water with chlorpyrifos levels greater than 0.03 milligrams per liter (mg/L) of water (0.03 mg/L) for periods of 1–10 days (ATSDR 1997).

- The FDA has set tolerances for chlorpyrifos for agricultural products ranging from 0.05 to 15 parts chlorpyrifos per million parts of food (0.05–15 ppm) (ATSDR 1997).

1.1.3 Copper

Copper is a reddish metal that occurs naturally in rocks, soil, water, and air; and, also occurs naturally in plants and animals. Metallic copper can be easily molded or shaped. Metallic copper can be found in the U.S. penny, electrical wiring, and some water pipes. Metallic copper is also found in mixtures (called alloys) with other metals such as brass and bronze. Copper is also found as part of other compounds forming salts. Copper salts occur naturally, but are also manufactured. The most common copper salt is copper sulfate. Most copper compounds are blue-green in color. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics (ATSDR 2002h).

Copper can enter the environment from the mining of copper and other metals and from factories that make or use metallic copper or copper compounds. It can also enter the environment through domestic waste water, combustion of fossil fuels and wastes, wood production, phosphate fertilizer production, and natural sources (e.g., windblown dust from soils, volcanoes, decaying vegetation, forest fires, and sea spray). Copper in soil strongly attaches to organic material and minerals, but does not break down in the environment. Copper that dissolves in water becomes rapidly bound to particles suspended in the water. Copper does not typically enter groundwater. Copper carried by particles emitted from smelters and ore processing plants is carried back to the ground by gravity or in rain or snow. Exposure to copper occurs through breathing air, drinking water, eating food, and by skin contact with soil, water, or other copper-containing substances. Plants and animals can take up some copper in the environment.

Copper is essential for good health, but high amounts can be harmful. Long-term exposure to copper dust can irritate the nose, mouth, and eyes, and cause headaches, dizziness, nausea, and diarrhea. Drinking water with higher than normal levels of copper may cause vomiting, diarrhea, stomach cramps, and nausea. Ingestion of large amounts of copper can cause liver and kidney damage and even death. Federal agencies made several recommendations to protect human health, including:

- The EPA has determined that drinking water should not contain more than 1.3 milligrams of copper per liter of water (1.3 mg/L) (ATSDR 2002h).

- The OSHA has set a limit of 0.1 mg per cubic meter (0.1 mg/m^3) of copper fumes (vapor generated from heating copper) and 1 mg/m^3 of copper dusts (fine metallic copper particles) and mists (aerosol of soluble copper) in workroom air during an 8-hour work shift, 40-hour workweek (ATSDR 2002h).

- The Food and Nutrition Board of the Institute of Medicine recommends dietary allowances (RDAs) of 340 micrograms (340 µ g) of copper per day for children aged 1-3 years, 440 g/day for children aged 4-8 years, 700 µg/day for children aged 9-13 years, 890 µg/day for children aged 14-18 years, and 900 g/day for adults (ATSDR 2002h).

1.1.4 DDT

- DDT (dichlorodiphenyltrichloroethane) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria. DDT is a white, crystalline solid with no odor or taste. Its use in the U.S. was banned in 1972 because of damage to wildlife, but is still used in some countries. DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane) are chemicals similar to DDT that contaminate commercial DDT preparations (ATSDR 2002i).

- DDT entered the environment when it was used as a pesticide; it still enters the environment due to current use in other countries. DDT sticks strongly to soil; most DDT in soil is broken down slowly to DDE and DDD by microorganisms. Half the DDT in soil will break down in 2-15 years, depending on the type of soil. Only a small amount will go through the soil into groundwater; DDT does not dissolve easily in water. DDT, and especially DDE, build up in plants and in fatty tissues of fish, birds, and other animals. Exposure to DDT occurs through eating contaminated foods, such as root and leafy vegetable, fatty meat, fish, and poultry, but levels are very low; eating contaminated imported foods from countries that still allow the use of DDT to control pests; breathing contaminated air or drinking contaminated water near waste sites and landfills that may contain higher levels of these chemicals; infants fed on breast milk from mothers who have been exposed; and breathing or swallowing soil particles near waste sites or landfills that contain these chemicals.

- DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months. A study in humans showed that women who had high amounts of a form of DDE in their breast milk were unable to breast feed their babies for as long as women who had little DDE in the breast milk. Another study in humans showed that women who had high amounts of DDE in breast milk had an increased chance of having premature babies. In animals, short-term exposure to large amounts of DDT in food affected the nervous system, while long-term exposure to smaller amounts affected the liver. Short-term oral exposure to small amounts of DDT or its breakdown products may also have harmful effects on animal reproduction. Federal agencies have made several recommendations to protect human health, including:

- The OSHA sets a limit of 1 milligram of DDT per cubic meter of air (1 mg/m^3) in the workplace for an 8-hour shift, 40-hour workweek (ATSDR 2002i).
- The FDA has set limits for DDT, DDE, and DDD in foodstuff at or above which the agency will take legal action to remove the products from the market (ATSDR 2002i).

1.1.5 Diazinon

Diazinon is the common name of an organophosphorus insecticide used to control pest insects in soil, on ornamental plants, and on fruit and vegetable field crops. It is also used to control household pests such as flies, fleas, and cockroaches. This chemical is manufactured and does not occur naturally in the environment. The pure chemical is a colorless and practically odorless oil. Most of the diazinon used is in liquid form, but it is possible to be exposed to the chemical in a solid form. Diazinon does not burn easily and does not dissolve easily in water (ATSDR. 1996a).

Most environmental diazinon contamination comes from agricultural and household application to control insects. Diazinon may also enter the environment during the manufacturing process. It is often sprayed on crops and plants, so small particles of the chemical may be carried away from the field or yard before falling to the ground. After diazinon has been applied, it may be present in the soil, surface waters, and on the surface of the plants. Diazinon on soil and plant surfaces may be washed into surface waters by rain. In the environment, diazinon is rapidly broken down into a variety of other chemicals. It can move through the soil and contaminate ground water. Diazinon is not likely to build up to high or dangerous levels in animal or plant foods. Exposure to diazinon occurs through contact with contaminated soils or contaminated runoff water or groundwater. People who work in the manufacture and professional application of diazinon have the most significant exposure to this insecticide.

Most cases of unintentional diazinon poisoning in people have resulted from short exposures to very high concentrations of the material. Diazinon affects the nervous system. Some mild symptoms include headache, dizziness, weakness, feelings of anxiety, constriction of the pupils of the eye, and not being able to see clearly. More severe symptoms include nausea and vomiting, abdominal cramps, slow pulse, diarrhea, pinpoint pupils, difficulty breathing, and coma. The EPA has developed 1- and 10-day health advisories (maximum recommended drinking water concentrations) for adults and children of 20 micrograms per liter of water (20 µg/L) (ATSDR 1996a).

1.1.6 Dioxin Compounds

The chlorinated dibenzo-p-dioxins (CDDs) are a class of compounds that are loosely referred to as dioxins. There are 75 possible dioxins. One of these compounds is called 2,3,7,8-TCDD. It is one of the most toxic of the CDDs and is the one most studied. In the pure form, CDDs are crystals or colorless solids. CDDs enter the environment as mixtures containing a number of individual components. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known. CDDs are not intentionally manufactured by industry except for research purposes or as by-products. They (mainly 2,3,7,8-TCDD) may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators (ATSDR 1998).

When released into the air, some CDDs may be transported long distances, even around the globe. When released in waste waters, some CDDs are broken down by sunlight, some evaporate to air, but most attach to soil and settle to the bottom sediment in water. CDD concentrations may build up in the food chain, resulting in measurable levels in animals. Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population. Exposure could also occur by breathing low levels in air and drinking low levels in water; skin contact with certain pesticides and herbicides; living near an uncontrolled hazardous waste site containing CDDs or incinerators releasing CDDs; and working in industries involved in producing certain pesticides containing CDDs as impurities, working at paper and pulp mills, or operating incinerators.

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. Exposure to high concentrations of CDDs may induce long-term alterations in glucose metabolism and subtle changes in hormonal levels. In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. Exposure to lower levels can cause a variety of effects in animals, such as weight loss, liver damage, and disruption of the endocrine system. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. The EPA has set a limit of 0.00003 micrograms of 2,3,7,8-TCDD per liter of drinking water (0.00003 μg/L) (ATSDR 1998). Discharges, spills, or accidental releases of 1 pound or more of 2,3,7,8-TCDD must be reported to EPA. The FDA recommends against eating fish and shellfish with levels of 2,3,7,8-TCDD greater than 50 parts per trillion (50 ppt) (ATSDR 1998).

1.1.7 Electrical Conductivity

Conductivity is the ability of water to conduct an electrical current. Dissolved ions in the water are conductors. The major positively charged ions are sodium, (Na^+) calcium (Ca^{+2}), potassium (K^+) and magnesium (Mg^{+2}). The major negatively charged ions are chloride (Cl^-), sulfate (SO_4^{-2}), carbonate (CO_3^{-2}), and bicarbonate (HCO_3^-). Nitrates (NO_3^{-2}) and phosphates (PO_4^{-3}) are minor contributors to conductivity, although very important biologically.

Salinity is a measure of the amount of salts in the water. Because dissolved ions increase salinity as well as conductivity, the two measures are related. Conductivity can affect the quality of water used for irrigation or drinking. Most aquatic biota tolerate a range of conductivity. However, the ionic composition of the water can be critical. For example, cladocerans (water fleas) are far more sensitive to potassium chloride than sodium chloride at the same concentration. Conductivity will vary with water source: groundwater, water drained from agricultural fields, municipal waste water, rainfall. Therefore, conductivity can indicate groundwater seepage or a sewage leak.

Conductivity is measured by an electronic probe which applies voltage between two electrodes. The drop in voltage is used to measure the resistance of the water, which is then converted to conductivity. Conductivity is the inverse of resistance and is measured in the amount of conductance over a certain distance. The units are mhos/cm, where mhos are the reciprocal of ohms. Salinity can be measured using a hydrometer or a refractometer. The hydrometer measures specific gravity, which can then be converted to salinity. The refractometer measures the ability of the water to refract light. Scientists also measure salinity by determining the amount of chlorine in seawater. Salinity is measured in grams/liter (g/l) or parts per thousand (ppt) in sea water.

In fresher waters, total dissolved solids is often measured instead of salinity. It is measured by filtering a sample, drying the water that has been filtered, and then weighing the remaining solids. TDS is the solid material left in the water after it has been dried and evaporated. The units of TDS are milligrams/liter (mg/l) or parts per million (ppm).

Several factors affect electrical conductivity in the water. Soil and rocks release ions into the waters that flow through or over them. The geology of a certain area will determine the amount and type of ions. The salinity and conductivity of coastal rivers is influenced by tides. Sea spray can carry salts into the air, which then fall back into the rivers with rainfall. The flow of rivers into estuaries can greatly affect salinity as well as the location of the estuarine mixing zone.

The water quality objectives for conductivity vary from region to region. Water quality objectives are included in the RWQCB Basin Plans. In some cases, there are no objectives for conductivity, but there are for total dissolved solids (TDS). Conductivity can be estimated from TDS values and vice versa.

1.1.8 Exotic Species

A species is a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms. An exotic species is defined as any species that is not native to a particular ecosystem, including its seeds, eggs, spores, or other biological material capable of propagating that species. Synonyms for exotic species include non-native species, nonindigenous species, and alien species. When an exotic species is introduced into a new ecosystem, there is potential for significant disruption of the balance among existing native and naturalized species, especially if the exotic species competes with native species for resources and no predators are able to control the population of the exotic species. When an exotic species does or is likely to cause economic or environmental harm, or harm to human health, it is known as an "invasive species." Yet another synonym for such an organism occurring in or near waters is "aquatic nuisance species," or ANS, as defined in the National Invasive Species Act (NISA). Competition with and predation by invasive species affects 49 percent of endangered or threatened species in the United States (Wilcove et al. 1998). About 42 percent of the species listed as endangered or threatened under the Endangered Species Act of 1973 are at risk primarily because of exotic species (Pimentel et al. 1999).

Although the effects of many exotic species introductions remain unmeasured, it is clear that some "invasive" exotic species, or ANS, are having significant economic and ecological impacts as well as human-health consequences. Today, the main method by which exotic species are transported between biogeographic regions of the Earth is moving species via ships on their exteriors or in their ballast water (SERC 2000). Ballast-mediated introductions such as the zebra mussel in the U.S. Great Lakes and toxic dinoflagellates in Australia have had tremendous ecological and economic impacts. Water-borne diseases such as cholera and hepatitis can be transported with ballast water (Knight 1999; Harvell et al. 1985). While the ship vector is probably the greatest source, there are other sources of exotic species to aquatic ecosystems, which include the aquaculture and baitfish industries, dumping of aquariums into surface waters, and intentional introductions.

1.1.9 Furan Compounds

The polychlorinated dibenzofurans (PCDFs) are a group of 135 halogenated uicyclic aromatic hydrocarbons with many structural, distribution, and toxicity similarities to the dioxins (polychlorinated dibenzodioxins, PCDDs). Very little is known about the individual furans because they typically occur as mixtures of different forms. For this reason, the sources, environmental fates, and health effects of the PCDFs will be discussed as a group, with mention of individual furans when appropriate.

PCDFs are not intentionally produced for any commercial purposes. PCDF contamination of products or processes has not caused the banning or restriction of use in the U.S. Just like the PCDDs, PCDFs are unwanted trace impurities of PCBs, chlorinated phenols such as hexachlorobenzene or pentachlorophenol, and phenoxy herbicides. The production of many of these compounds has been restricted or banned (e.g., PCBs), but products containing them may still be in use (e.g., electrical transformers). Example concentrations are listed below:

- Phenoxy herbicides had 0.008-0.15 mg/kg PCDFs (Rappe et al. 1978 1979; Ah-ling et al. 1977).
- Pentachlorophenol has contained 59.8-790 mg/kg PCDFs (Rappe et al. 1979).
- Hexachiorobenzene was found to contain 0.35 to 58.3 mg/kg PCDFs (Villanueva et al. 1974).
- PCDF contaminants in polychiorinated biphenyls (PCBs) have been measured at levels of 0.8 to 13.6 mg/kg (CNRC 1978).
- Incineration of municipal and industrial wastes at too low a temperature (~800° C) can produce PCDFs, which can be released to the environment either in flue gas or adsorbed to fly ash (U.S. EPA 1986).

The compound 2,3,7,8 TCDF is the only PCDF for which a number of physical and chemical properties have been determined. Based on these properties, and its structural similarity to the dioxin 2,3,7,8, TCDD, 2,3,7,8 TCDF is likely to be only slightly soluble in water and strongly absorb to soil. It also has a high potential for bioaccumulation (Hansch and Leo 1981). Because 2,3,7,8 TCDF strongly sorbs to sediments, it persists in soils and aquatic systems. Some photodegradation can occur with tetra- and penta-CDFs losing chlorine atoms and forming tri-CDFs. Very little is known about the biodegradation of PCDFs, but they are probably like the dioxins and relatively resistant to biodegradation (U.S. EPA 1986b).

Human exposure to PCDFs occurred in two major incidents when PCBs (containing a mixture of PCDFs) accidentally contaminated rice oil in Japan and China. The resulting symptoms (attributed to 2,3,4,7,8 PeCDF exposure) consisted of liver disturbances, skin lesions, excessive skin pigmentation, temporary blindness, numbness of feet and hands, and weakness (Kuratsune et al. 1972; Kuratsune 1975, 1980; Urabe and Asahi 1985; Lu and Wu 1985). Studies of potential carcinogenesis in humans are still ongoing. No tests have been conducted with animals (U.S. EPA 1986b). Reproductive effects include:

- 1,2,3,4,7,8 PeCDF, 1,2,3,7,8 PeCDF and 1,2,3,4,7,8 HxCDF can cause kidney damage and cleft palate in mouse fetuses (U.S. EPA 1986b).

The four PCDFs (2,8 DCDF; 3,6 DCDF; 2,3,7,8 TCDF; and OCDF) tested for mutagenicity in bacteria had negative results (U.S. EPA 1986b). The Toxicological Effects Indices are:

- Reference Dose (RfD), 2,3,7,8 TCDF: 2x10-5 CLg/kg/day (U.S. EPA 1986b).

- Reference Dose (RfD), 2,3,4,7,8 PeCDF: 3x10-6 t.tg/kg/day (U.S. EPA 1986b).
- Oral LD50 values for 2,3,7,8 TCDF: guinea pigs, 5-10 pg/kg; mice and rats, > 6000 PgAcg; rhesus monkey, 1000 pg/kg (U.S. EPA 1986b).

1.1.10 Group A Pesticides

1.1.10.1 Aldrin and Dieldrin

Aldrin and dieldrin are insecticides with similar chemical structures. They are discussed together in this fact sheet because aldrin quickly breaks down to dieldrin in the body and in the environment.

Pure aldrin and dieldrin are white powders with a mild chemical odor. The less pure commercial powders have a tan color. Neither substance occurs naturally in the environment. From the 1950s until 1970, aldrin and dieldrin were widely used pesticides for crops like corn and cotton. Because of concerns about damage to the environment and potentially to human health, EPA banned all uses of aldrin and dieldrin in 1974, except to control termites. In 1987, EPA banned all uses (ATSDR. 2002a).

Sunlight and bacteria change aldrin to dieldrin so that dieldrin is the compound more likely to be found in the environment. They bind tightly to soil and slowly evaporate to the air. Dieldrin in soil and water breaks down very slowly. Plants take in and store aldrin and dieldrin from the soil. Aldrin also rapidly changes to dieldrin in plants and animals. Dieldrin is stored in the fat and leaves the body very slowly. Dieldrin is everywhere in the environment, but at very low levels. Exposure could occur through eating food like fish or shellfish from lakes or streams contaminated with either chemical, or contaminated root crops, dairy products, or meats. Air, surface water, or soil near waste sites may contain higher levels.

People who have ingested large amounts of aldrin or dieldrin suffered convulsions and some died. Health effects may also occur after a longer period of exposure to smaller amounts because these chemicals build up in the body. Some workers exposed to moderate levels in the air for a long time had headaches, dizziness, irritability, vomiting, and uncontrolled muscle movements. Workers removed from the source of exposure rapidly recovered from most of these effects. Animals exposed to high amounts of aldrin or dieldrin also had nervous system effects. In animals, oral exposure to lower levels for a long period also affected the liver and decreased their ability to fight infections. Federal agencies have made several recommendations to protect human health, including:

- The EPA limits the amount of aldrin and dieldrin that may be present in drinking water to 0.001 and 0.002 mg/L of water, respectively, for protection against health effects other than cancer. The EPA has determined that a maximum concentration of aldrin and dieldrin of 0.0002 mg/L in drinking water limits the lifetime risk of developing cancer from exposure to each compound to 1 in 10,000 (ATSDR 2002a).

- The OSHA sets a maximum average of 0.25 milligrams of aldrin and dieldrin per cubic meter of air (0.25 mg/m^3) in the workplace during an 8-hour shift, 40-hour workweek. NIOSH also recommends a limit of 0.25 mg/m^3 for both compounds for up to a 10-hour work day, 40-hour week (ATSDR 2002a).

- The FDA regulates the residues of aldrin and dieldrin in raw foods. The allowable range is from 0 to 0.1 ppm, depending on the type of food product (ATSDR 2002a).

1.1.10.2 Endrin

Endrin is a solid, white, almost odorless substance that was used as a pesticide to control insects, rodents, and birds. Endrin has not been produced or sold for general use in the United States since 1986. Little is known about the properties of endrin aldehyde (an impurity and breakdown product of endrin) or endrin ketone (a product of endrin when it is exposed to light) (ATSDR 2002j).

Endrin does not dissolve very well in water. It has been found in groundwater and surface water, but only at very low levels. It is more likely to cling to the bottom sediments of rivers, lakes, and other bodies of water. Endrin is generally not found in the air except when it has been applied to fields during agricultural applications. The persistence of endrin in the environment depends highly on local conditions. Some estimates indicate that endrin can stay in soil for over 10 years. Endrin may also be broken down by exposure to high temperatures or light to form primarily endrin ketone and endrin aldehyde. It is not known what happens to endrin aldehyde or endrin ketone once they are released to the environment. However, the amount of endrin broken down to endrin aldehyde or endrin ketone is very small.

Humans may be exposed to endrin in air, water, or soil if living near a hazardous waste site. Humans may be exposed by eating foods that contain endrin. Children living near hazardous waste sites could be exposed to endrin in contaminated soils if they eat dirt. Endrin levels can build up in the tissues of organisms that live in water. Human breast milk may be a route of exposure for nursing infants.

Exposure to endrin can cause various harmful effects including death and severe central nervous system (brain and spinal cord) injury. Swallowing large amounts of endrin may cause convulsions and kill in a few minutes or hours. Symptoms that may result from endrin poisoning are headaches, dizziness, nervousness, confusion, nausea, vomiting, and convulsions. No long-term health effects have been noted in workers who have been exposed to endrin by breathing or touching it. The federal government has made several recommendations to protect human health, including:

- The EPA's maximum contaminant level (MCL) for endrin in drinking water is 0.0002 milligrams per liter (0.0002 mg/L) (ATSDR 2002j).

- The OSHA has established a limit of 0.1 mg endrin per cubic meter of air (0.1 mg/m^3) for an 8-hour day in a 40-hour workweek (ATSDR 2002j).

1.1.10.3 Chlordane

Chlordane is a manufactured chemical that was used as a pesticide in the United States from 1948 to 1988. Technically, chlordane is not a single chemical, but is actually a mixture of pure chlordane mixed with many related chemicals. It does not occur naturally in the environment. It is a thick liquid whose color ranges from colorless to amber. Chlordane has a mild, irritating smell. Some of its trade names are Octachlor and Velsicol 1068. Until 1983, chlordane was used as a pesticide on crops like corn and citrus and on home lawns and gardens. Because of concern about damage to the environment and harm to human health, the EPA banned all uses of chlordane in 1983 except to control termites. In 1988, EPA banned all uses (ATSDR 2002b).

Chlordane entered the environment through its use as a pesticide on and as termite control. Chlordane sticks strongly to soil particles at the surface and is not likely to enter groundwater. It can stay in the soil for over 20 years. Most chlordane leaves soil by evaporation to the air, where it breaks down very slowly. Chlordane doesn't dissolve easily in water. It builds up in the tissues of fish, birds, and mammals. Exposure to chlordane could occur by eating crops grown in soil that contains chlordane; eating fish or shellfish caught in water that is contaminated by chlordane; breathing air or touching soil near homes treated for termites with chlordane; and by breathing air or by touching soil near waste sites or landfills.

Chlordane affects the nervous system, the digestive system, and the liver in people and animals. Headaches, irritability, confusion, weakness, vision problems, vomiting, stomach cramps, diarrhea, and jaundice have occurred in people who breathed air containing high concentrations of chlordane or accidentally swallowed small amounts of chlordane. Large amounts of chlordane taken by mouth can cause convulsions and death in people. Federal agencies have made several recommendations to protect human health, including:

- The EPA recommends that a child should not drink water with more than 60 parts of chlordane per billion parts of drinking water (60 ppb) for longer than 1 day. EPA has set a limit in drinking water of 2 ppb.

- EPA requires spills or releases of chlordane into the environment of 1 pound or more to be reported to EPA (ATSDR 2002b).

- The FDA limits the amount of chlordane and its breakdown products in most fruits and vegetables to less than 300 ppb and in animal fat and fish to less than 100 ppb (ATSDR 2002b).

- The OSHA, the NIOSH, and the American Conference of Governmental Industrial Hygienists (ACGIH) set a maximum level of 0.5 milligrams of chlordane per cubic meter (mg/m^3) in workplace air for an 8-hour workday, 40-hour workweek. These agencies have advised that eye and skin contact should be avoided because this may be a significant route of exposure (ATSDR 2002b).

1.1.10.4 Heptachlor and Heptachlor Epoxide

Heptachlor is a manufactured chemical and does not occur naturally. Pure heptachlor is a white powder that smells like camphor (mothballs). The less pure grade is tan. Trade names include Heptagran®, Basaklor®, Drinox®, Soleptax®, Termide®, and Velsicol 104®. Heptachlor was used extensively in the past for killing insects in homes, buildings, and on food crops, especially corn. Use slowed in the 1970s and stopped in 1988. Heptachlor epoxide is also a white powder and is a breakdown product of heptachlor. The epoxide is more likely to be found in the environment than heptachlor (ATSDR 2002d).

Heptachlor doesn't dissolve easily in water; heptachlor epoxide dissolves more easily. Each form sticks strongly to soil particles and evaporates slowly to air. Heptachlor epoxide can stay in the soil and water for many years. Animals change heptachlor to the epoxide. Plants can take up heptachlor from the soil. Levels build up in the tissues of fish and cattle.

Heptachlor and Heptachlor Epoxide exposure may occur by eating crops grown in soil that contains heptachlor and by eating fish, dairy products, and fatty meats from animals exposed to heptachlor in their food. Humans can also be exposed by breathing air, drinking water, or experiencing skin contact with soil near waste sites or landfills. Breast milk (from mothers who had high exposures) can also transmit Heptachlor and Heptachlor Epoxide.

Heptachlor and heptachlor epoxide are clearly toxic to humans and animals and can damage the nervous system. There are some human data on brief exposures to high levels. A few reports showed that people who accidentally swallowed pesticides containing heptachlor, or who spilled pesticides on their clothes became dizzy, confused, or had convulsions. The Federal government has made several recommendations to protect human health, including:

- The EPA banned the sale of all heptachlor products and restricted the use of heptachlor to the control of fire ants in power transformers. EPA recommends a maximum of 2.78 parts of heptachlor and heptachlor epoxide per trillion parts of drinking water or seafood (2.78 ppt) to eat each day. For longer exposures, a child should not drink water with greater than 5,000 ppt heptachlor or 150 ppt heptachlor epoxide. Quantities greater than 1 pound of heptachlor or heptachlor epoxide that enter the environment must immediately be reported to the National Response Center (ATSDR 2002d).

- The FDA limits the amount of heptachlor and heptachlor epoxide on raw food crops and on edible seafood to 0-10 parts per billion (ppb), depending on the type of food product. The limit on edible seafood is 300 ppb, and for the fat of food-producing animals is 200 ppb (ATSDR 2002d).

- The American Conference of Governmental Industrial Hygienists (ACGIH) and the OSHA recommend a maximum in workplace air over an 8-hour workday for a

40-hour workweek of 0.5 milligrams of heptachlor per cubic meter (0.5 mg/m^3) (ATSDR 2002d).

1.1.10.5 Hexachlorocyclohexane (including lindane)

Hexachlorocyclohexanes (HCH) are a group of manufactured chemicals that do not occur naturally in the environment. HCH has eight chemical forms (called isomers). The four most common are alpha-, beta-, gamma, and delta-HCH. The most common of these is gamma-HCH (also known as lindane). Lindane is a white solid substance that may evaporate into the air as a colorless vapor with a slightly musty odor. It is the common form of hexachlorocyclohexane. Lindane was used as an insecticide on fruit and vegetable crops (including greenhouse vegetables and tobacco) and forest crops (including Christmas trees). It is still used in ointments to treat head and body lice, and scabies. Lindane has not been produced in the United States since 1977. It is still imported to and formulated in the United States (ATSDR 2002de).

In air, HCH can be present as a vapor or attached to small particles such as soil or dust. Lindane can remain in the air for up to 17 weeks and travel long distances. Particles with attached HCH may be removed from the air by rain. In soil, sediments, and water, it is broken down by algae, fungi, and bacteria to less harmful substances. HCH isomers are broken down quickly in water; lindane does not remain in water longer than 30 days. The length of time that HCH isomers remain in soil is not known. It can accumulate in the fatty tissue of fish.

Humans may be exposed to HCH by eating contaminated foods, such as plants, meat, and milk, or by breathing contaminated air in or near factories where products using HCH are made. Humans can also be exposed through skin when applied as a lotion or shampoo to control lice and scabie or by drinking contaminated water or breathing contaminated air near waste sites or landfills. Some people who breathed contaminated workplace air during the manufacturing of pesticides, including lindane, had blood disorders, dizziness, headaches, and changes in the levels of sex hormones. Some people who swallowed large amounts had seizures and sometimes died. The Federal government has made several recommendations to protect human health, including:

- The EPA has set a limit in drinking water of 0.2 parts of lindane per billion parts of water (0.2 ppb). The EPA requires that spills or accidental discharges of lindane into the environment of 1 pound or more must be reported to the EPA (ATSDR 2002de).

- The OSHA, the NIOSH, and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend a maximum level of 0.5 milligrams lindane per cubic meter (0.5 mg/m^3) of workplace air for an 8-hour workday, 40-hour workweek. These agencies advise avoiding eye and skin contact because this may be a route of significant exposure (ATSDR 2002de).

1.1.10.6 Endosulfan

Endosulfan is a pesticide. It is a cream- to brown-colored solid that may appear in the form of crystals or flakes. It has a smell like turpentine, but does not burn. It does not occur naturally in the environment. Endosulfan is used to control insects on food and non-food crops and as a wood preservative (ATSDR 2002c).

Endosulfan enters the air, water, and soil during its manufacture and use. It is often sprayed onto crops and the spray may travel long distances before it lands on crops, soil, or water. Endosulfan on crops usually breaks down in a few weeks, but endosulfan sticks to soil particles and may take years to completely break down. Endosulfan does not dissolve easily in water. Endosulfan in surface water is attached to soil particles floating in water or attached to soil at the bottom. Endosulfan can build up in the bodies of animals that live in endosulfan-contaminated water.

Humans may be exposed to endosulfan by eating food contaminated with endosulfan, but levels in foods are very low. People working in industries involved in making endosulfan or working as pesticide applicators can also be exposed. Skin contact with soil containing endosulfan can also cause exposure.

Endosulfan affects the central nervous system and prevents it from working properly. Hyperactivity, nausea, dizziness, headache, or convulsions have been observed in adults exposed to high doses. Severe poisoning may result in death. The federal government has made several recommendations to protect human health, including:

- The EPA recommends that the amount of endosulfan in rivers, lakes, and streams should not be more than 74 parts per billion (74 ppb) (ATSDR 2002c).
- The FDA allows no more than 24 parts per million (24 ppm) endosulfan on dried tea (ATSDR 2002c).
- EPA allows no more than 0.1 to 2 ppm endosulfan on other raw agricultural products (ATSDR 2002c).

1.1.10.7 Toxaphene

Toxaphene is an insecticide containing over 670 chemicals. It is usually found as a solid or gas, and in its original form it is a yellow to amber waxy solid that smells like turpentine. It does not burn and evaporates when in solid form or when mixed with liquids. Toxaphene is also known as camphechlor, chlorocamphene, polychlorocamphene, and chlorinated camphene. Toxaphene was one of the most heavily used insecticides in the United States until 1982, when it was canceled for most uses; all uses were banned in 1990. It was used primarily in the southern United States to control insect pests on cotton and other crops. It was also used to control insect pests on livestock and to kill unwanted fish in lakes (ATSDR 2002f).

Toxaphene may enter the environment from hazardous waste sites. It may enter the air by evaporation. It does not dissolve well in water, so it is more likely to be found in air, soil, or sediment at the bottom of lakes or streams, than in surface water. Toxaphene breaks down very slowly in the environment. Toxaphene accumulates in fish and mammals.

People who breathe air near a hazardous waste site where toxaphene was disposed could be exposed to it. Eating contaminated soil could expose infants or toddlers. People who eat large quantities of fish and shellfish, which were contaminated with toxaphene, could be exposed. People who drink water from wells containing toxaphene could also be exposed.

Breathing, eating, or drinking high levels of toxaphene could damage the lungs, nervous system, and kidneys, and can even cause death. However, since toxaphene is no longer used in the United States, most people would not be exposed to high levels of it. People could be exposed to low levels of it; however, there is no information on how low levels affect people. Federal agencies have made several recommendations to protect human health, including:

- The EPA has set a drinking water standard of 0.003 milligrams of toxaphene per liter of drinking water (0.003 mg/L) (ATSDR 2002f).
- The EPA also requires spills or accidental releases into the environment of 1 pound or more of toxaphene be reported.
- The OSHA has set a permissible exposure limit of 0.5 milligrams toxaphene per cubic meter of air (0.5 mg/m3) for an 8-hour workday, 40 hour workweek(ATSDR 2002f).
- NIOSH recommends that toxaphene levels should be as low as possible in the workplace due to its potential carcinogenicity (ATSDR 2002f).
- The American Conference of Governmental Industrial Hydienists (ACGIH) recommend 0.5 mg/m3 for an 8-hour workday, 40-hour workweek. They also recommend that 1 mg/m3 be considered a level that should not be exceeded in a 15-minute period.

1.1.11 Mercury

Mercury is a naturally occurring metal that has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or “salts,” which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make. Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments (ATSDR 1999b).

Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants. It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity. Methylmercury may be formed in water and soil by bacteria. Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury. Exposure to mercury can occur through eating fish or shellfish contaminated with methylmercury; breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels, release of mercury from dental work and medical treatments; and breathing contaminated workplace air or skin contact during use in the workplace (from businesses and industries that use mercury).

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems. Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation. Federal agencies have made several recommendations to protect human health, including:

- The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb) (ATSDR 1999b).
- The FDA has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm) (ATSDR 1999b).
- The OSHA has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m3) and 0.05 mg/m3 of metallic mercury vapor for 8-hour shifts and 40-hour workweeks (ATSDR 1999b).

1.1.12 PCBs

Polychlorinated biphenyls (PCBs) are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor (ATSDR 2000).

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs. PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators. PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil. PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. Federal agencies have made several recommendations to protect human health, including

- The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L) (ATSDR 2002).
- Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA (ATSDR 2002).
- The FDA requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food (ATSDR 2002).
- Many states also have established fish and wildlife consumption advisories for PCBs (ATSDR 2002).

1.1.13 Selenium

Selenium is a metal commonly found in rocks and soil. In the environment, selenium is not often found in the pure form. Much of the selenium in rocks is combined with sulfide minerals or with silver, copper, lead, and nickel minerals. Selenium and oxygen combine to form several compounds. Selenium sulfide is a bright red-yellow powder used in anti-dandruff shampoo. Industrially produced hydrogen selenide is a colorless gas with a disagreeable odor. It is probably the only selenium compound that might pose a health concern in the workplace. Selenium dioxide is an industrially produced compound that dissolves in water to form selenious acid (ATSDR 1996a).

Small selenium particles in the air settle to the ground or are taken out of the air in rain. Soluble selenium compounds in agricultural fields can leave the field in irrigation drainage water. Selenium can collect in animals that live in water containing high levels of it. Exposure to selenium occurs by breathing air that contains it and by eating food, drinking water, or taking dietary supplements that contain it.

People exposed to very high levels of selenium have reported dizziness, fatigue, irritation, collection of fluid in the lungs, and severe bronchitis. The exact levels at which these effects occur are not known. Upon contact with skin, selenium compounds have caused rashes, swelling, and pain. Selenium compounds can be harmful at daily dietary levels 5–10 times higher than the daily requirement. Accidentally swallowing a large amount of selenium (for example, a very large quantity of selenium supplement pills) could be life-threatening without immediate medical treatment. If too much selenium is eaten over long periods of time, brittle hair and deformed nails can develop. People may also lose feeling and control in the arms and legs. Federal agencies have made several recommendations to protect human health, including:

- The EPA maximum contaminant level (MCL) for selenium in drinking water is 50 parts of selenium per billion parts of water (50 ppb) (ATSDR 1996a).
- The OSHA exposure limit for selenium compounds in workplace air is 0.2 milligrams of selenium per cubic meter of air (0.2 mg/m^3) for an 8-hour day over a 40-hour workweek (ATSDR 1996a).

1.1.14 Unknown Toxicity

An unknown toxicity is defined as a toxicity that has been found within a waterbody, but further testing has not been done to discover what the toxicity specifically is (N. Richard, pers. Comm., 2002). Unknown toxicities are found within waterbodies that have been monitored, tested, and sampled for toxicity in general and during testing, organism within the tested water have died.

1.1.15 Zinc

Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal. Zinc has many commercial uses: as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass and bronze. Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dye, wood preservatives, and ointments (ATSDR 1994).

Zinc is released into the environment by natural processes, but most comes from activities of people like mining, steel production, coal burning, and burning of waste. It attaches to soil, sediments, and dust particles in the air. Zinc compounds can move into the groundwater and into lakes, streams, and rivers. Most of the zinc in soil stays bound to soil particles. It builds up in fish and other organisms, but not in plants. Exposure to zinc can occur through ingesting small amounts present in food and water; drinking contaminated water near manufacturing or waste sites; and breathing zinc particles in the air at manufacturing sites.

Zinc is an essential element in the diet. Too little zinc can cause health problems, but too much zinc is also harmful. Eating large amounts of zinc, even for a short time, can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia, pancreas damage, and lower levels of high-density lipoprotein cholesterol (the good form of cholesterol). Breathing large amounts of zinc (as dust or fumes) can cause a specific short-term disease called metal fume fever. Long-term effects are unknown. Federal agencies have made several recommendations to protect human health, including:

- EPA recommends that there be no more than 5 parts of zinc in 1 million parts of drinking water (5 ppm) because of taste. EPA also requires that releases of more than 1,000 (or in some cases 5,000) pounds of zinc or its compounds into the environment be reported (ATSDR 1994).

- OSHA has set a maximum concentration limit for zinc chloride fumes in workplace air of 1 milligram of zinc per cubic meter of air (1 mg/m^3) for an 8-hour workday over a 40-hour workweek and 5 mg/m^3 for zinc oxide fumes (ATSDR 1994).

- NIOSH has set the same standards for up to a 10-hour workday over a 40-hour workweek.

1.2.1 Beneficial Uses

State law defines beneficial uses of California's waters that may be protected against quality degradation to include (but not limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)).

Beneficial use designation (and water quality objectives) must be reviewed at least once during each three-year period for the purpose of modification as appropriate (40

CFR 131.20). The beneficial uses, and abbreviations, listed below are standard basin plan designations (RWQCBCV 1998).

Municipal and Domestic Supply (MUN) - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR) - Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.

Areas of Special Biological Significance (ASBS) - Areas designated by the SWRCB. These include marine life refuges, and designated areas where the preservation and enhancement of natural resources requires special attention.

Industrial Service Supply (IND) - Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.

Industrial Process Supply (PRO) - Uses of water for industrial activities that depend primarily on water quality.

Ground Water Recharge (GWR) - Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH) - Uses of water for natural or artificial maintenance of surface water quantity or quality.

Navigation (NAV) - Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW) - Uses of water for hydropower generation.

Water Contact Recreation (REC-1) - Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, canoeing, white water activities, fishing, or use of natural hot springs.

Non-contact Water Recreation (REC-2) - Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM) - Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA) - Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM) - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST) - Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Wetland Habitat (WET) - Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

Wildlife Habitat (WILD) - Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats of Special Significance (BIOL) - Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance, where the preservation or enhancement of natural resources requires special protection.

Rare, Threatened, or Endangered Species (RARE) - Uses of water that support aquatic habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under State or Federal law as rare, threatened or endangered.

Migration of Aquatic Organisms (MIGR) - Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, and/or Early Development (SPWN) - Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL) - Uses of water that support habitats suitable for the collection of filter feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

Marine Habitat (MAR) - Uses of water that support marine ecosystems, including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shore birds).

1.3 San Joaquin-Sacramento Delta Region Water Quality

1.3.1 Constituents of Concern

The Delta is currently listed as impaired under Section 303(d) of the CWA for the following constituents: unknown toxicity, mercury, pesticides, and organic enrichment/low dissolved oxygen. The following paragraphs describe Delta water quality conditions with regards to these constituents.

The major sources of metals include abandoned mines, agricultural drainage, and urban runoff. In May and September from 1975 through 1993, DWR measured concentrations of nine trace metals at 11 sampling stations in the Bay-Delta and in Suisun Bay from 1975-1993. Trace metals (most frequently copper) exceeded the guidelines for fresh-water acute and chronic toxicity on 34 occasions (CALFED 2000a). Marine acute and chronic toxicity guidelines were exceeded 181 times, with copper accounting for 160 of these exceedances (CALFED 2000a). The Delta is currently listed as impaired for unknown toxicity under Section 303(d) of the CWA and the unknown toxicity TMDL to protect beneficial uses is scheduled for development by 2011 (see Table 5-5). In addition to trace metals, mining-related activities are known to be a source of mercury in the Delta. The Coast Ranges, on the west side of the Sacramento Valley, contain a large deposit of cinnabar (mercury ore). The majorities of the mercury mines in the Coast Ranges are abandoned and remain unclaimed. During the late 1800s and early 1900s, mercury was intensively mined and refined in the Coast Ranges, and then transported across the Central Valley to the Sierra Nevada for use in placer gold mining operations. Studies conducted by UC Davis and USGS illustrate that the sediments mobilized by hydraulic mining were ultimately transported to the Bay-Delta, where they formed marshes and islands or were deposited in shallow water (CALFED 2000a). The Delta is currently listed as impaired for mercury under Section 303(d) of the CWA. The mercury TMDL to protect beneficial uses is scheduled for development by 2004 (see Table 5-5).

Organophosphate pesticides, such as diazinon and chlorpyrifos, are used in the Central Valley on orchard crops including almonds, peaches, and prunes. These pesticides are applied during the dormant spray season from December through

February. Diazinon and chlorpyrifos also are used by commercial applicators and home owners to control common pests. Diazinon and chlorpyrifos have been detected in surface water during winter and early spring from applications to orchards, in irrigation return water during summer, and in urban runoff samples during both winter and summer. Organochlorine pesticides such as DDT, toxaphene, dieldrin, and chlordane were widely used in the Central Valley until the 1970s and remain very persistent. Residues of these agents are still widespread in the Central Valley and are mobilized during winter storms, by irrigation and dredging, and by construction activities (CALFED 2000a). These more persistent chlorinated hydrocarbon pesticides are consistently found throughout the system at higher levels than the less persistent organophosphate compounds (SWRCB 1997). The Delta is currently listed as impaired for a variety of pesticides including chlorpyrifos, DDT, diazinon, and Group A pesticides under Section 303(d) of the CWA and TMDLs to protect beneficial uses are scheduled for development from 2004 to 2011, depending upon the constituent (see Table 5-5).

The most serious nutrient enrichment problems in the Delta are found along the lower San Joaquin River and in certain localized areas receiving waste discharges, but having little or no net freshwater flow. These conditions result in low dissolved oxygen levels, which occur mainly in the late-summer and coincide with low river flows and high water temperatures. Channel deepening for navigational purposes further aggravates dissolved oxygen problems. Warm, shallow, dead-end sloughs of the eastern Delta support objectionable populations of planktonic blue-green algae during summer months. Floating and semi-attached aquatic plants, such as water primrose and water hyacinths, frequently clog waterways in the lower San Joaquin River system during the summer. Extensive growths of these plants also have been observed in the waterways of the Delta. These plants interfere with the passage of small boat traffic and contribute to the total organic load in the Bay-Delta system as they break loose and move downstream in the fall and winter. Much of the water in the Delta system is turbid as a result of an abundance of suspended silts, clays, and organic matter. Most of these sediments enter the tidal system with the flow of the major tributary rivers. Some enriched areas are turbid as a result of planktonic algal populations, but inorganic turbidity tends to suppress nuisance algal populations in much of the Delta (SWRCB 1997). The Delta is currently listed as impaired for organic enrichment/low dissolved oxygen under Section 303(d) of the Clean Water Act and TMDLs to protect beneficial uses are scheduled for development by 2004 (see Table 5-5).

1.3.2 Delta Drinking Water Quality Concerns

1.3.2.1 Salinity

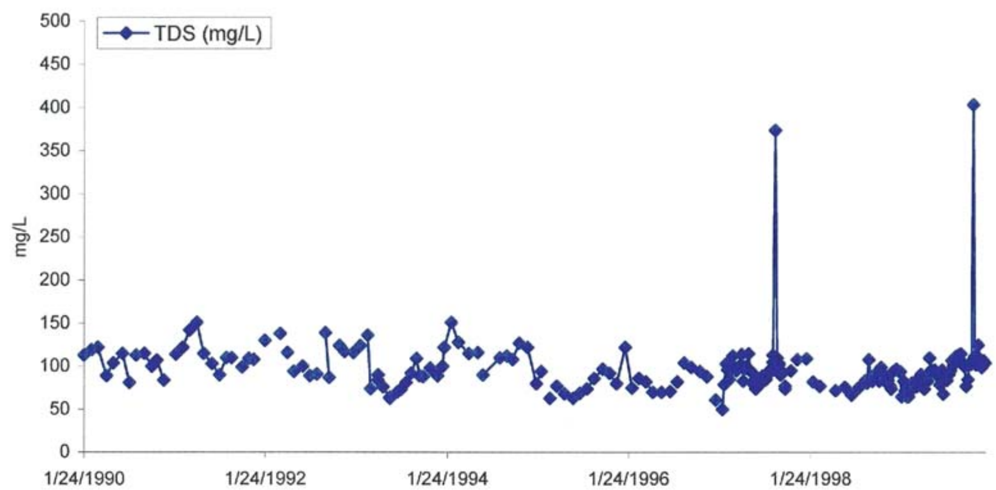
Excess salinity in Delta waters may affect agricultural, industrial, and municipal water supply beneficial uses, as well as habitat quality for aquatic biota in the Delta. Sources of salinity include sea-water intrusion, agricultural drainage, municipal wastewater, urban runoff, connate groundwater, and evapotranspiration of plants. Sea-water intrusion is the major source of salinity in the Delta (CALFED 2000a). With the exception of monitoring stations that are under the direct influence of tidal action, data analyses quantifying the contribution of seawater intrusion to TDS concentrations are scarce (DWR 2001b). However, because the EC of seawater is approximately 50,000 µS/cm, which is approximately 70 to 80 times greater than the daily average EC ranges at Banks Pumping Plant that signals DWR to consider allowing more freshwater into the system, it takes relatively little seawater to increase TDS or EC levels (DWR 2001b). Agricultural drainage, particularly from the San Joaquin Valley, is another important source of salinity, especially in the south Delta (CALFED 2000a).

Salinity control is necessary because the Delta is influenced by the ocean, and Delta water channels are at or below sea level (SWRCB 1997). The Sacramento and San Joaquin rivers unite at the western end of the Sacramento-San Joaquin Delta at Suisun Bay. From Suisun Bay, water flows through the Carquinez Strait into San Pablo Bay, then south into San Francisco Bay and out to sea through the Golden Gate Bridge (SWRCB 1997). Unless repelled by continuous seaward flow of freshwater, sea water will advance up the Estuary and into the Delta and degrade water quality (SWRCB 1997). Salinity varies geographically within the Delta varies seasonally within the Delta, and varies depending upon water year type.

CVP/SWP exports and pumping patterns have the potential to influence the direction of flow at various locations throughout the Delta, and thereby potentially affect the salinity at export locations. Operation of the Banks Pumping Plant and Tracy Pumping Plant draws high quality Sacramento River water across the Delta and restricts the low quality area to the southeast corner (SWRCB 1997). Each portion of the Delta is dominated by different hydraulic variables and therefore salinity varies within different sections of the Delta.

The Sacramento and San Joaquin rivers contribute approximately 61 percent and 33 percent, respectively, to tributary inflow TDS concentrations within the Delta. The relative concentrations of TDS are low in the Sacramento River, but because of its large volumetric contribution, the river contributes the majority of the TDS load supplied by tributary inflow to the Delta (DWR 2001b). TDS monitoring in the Sacramento River at Greenes Landing/Hood, downstream of the City of Sacramento and downstream of the last urban discharge point, illustrates that TDS concentrations at this location are consistently below the secondary MCL of 500 mg/L (see Figure G-1). Although actual flow from the San Joaquin River is lower than the Sacramento River, the TDS concentrations in San Joaquin River water averages approximately seven times that of the Sacramento River, resulting in a net contribution of 33 percent of the TDS from tributary inflow to the Delta.

In addition to varying geographically within the Delta, salinity varies seasonally, depending on the quantity and quality of freshwater inflows. During winter and early-spring, flows through the Delta are usually above the minimum required to control salinity. At least for a few months in the summer and fall of most years, however, salinity must be carefully monitored and controlled (SWRCB 1997). During the summer, salinity in the Delta may increase due to decreased inflows or increased salt loading resulting from agricultural runoff. Additionally, decreased inflow during the late summer increases the possibility that reverse flow would cause increased intrusion of saline water within the Delta. Salinity control and monitoring is provided by the CVP and SWP, and regulated by the SWRCB under its water rights authority. Salinity must be carefully monitored because water exported from the Delta for delivery to CVP and SWP contractors is used for a variety of municipal, industrial, and agricultural uses (SWRCB 1997, CALFED 2002a).



Source: DWR 2001b.

Figure G-1
TDS (mg/L) Sacramento River at Greenes Landing/Hood, 1990 to 1999

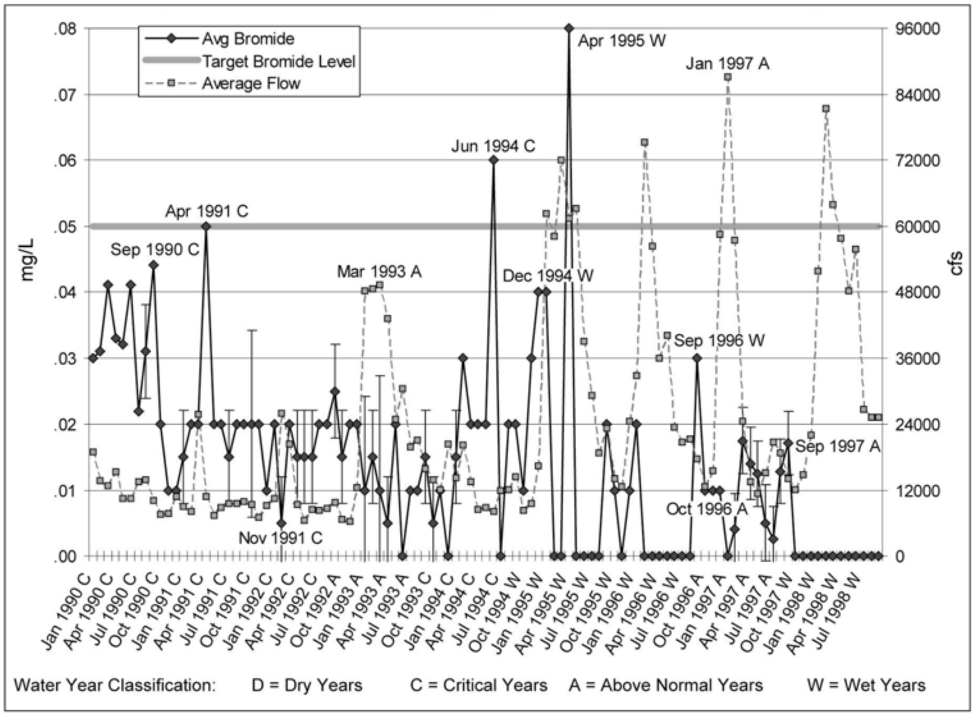
1.3.2.2 Bromide

Bromides are formed by the reaction of bromine or a bromide with another substance and are widely distributed in nature. The presence of bromide in source waters may shift the proportion of bromine containing DBPs (such as THMs) to higher levels (CALFED 2000b). The existing MRDL limits the sum of the four species, termed TTHMs, at 0.080 mg/L (see Table 5-1). Health effects potentially resulting from long-term ingestion of drinking water containing THMs in excess of EPA's standard may include problems with the liver, kidneys, or central nervous system, and long-term exposure may result in an increased risk of getting cancer (EPA 2003). Because disinfection with chlorine can result in formation of THMs, some wastewater treatment facilities are switching to ozone as a disinfectant. Use of ozone as a disinfectant has the advantage that it does not produce THMs (Sawyer et al. 1994). However, bromate is formed when ozone contacts water with bromide in it. Bromate also is regulated in drinking water because long-term exposure to bromate may result in an increased cancer risk (EPA 2003).

The primary source of bromide in Delta waters is sea-water intrusion (CALFED 2000a). DWR's Municipal Water Quality Investigations (MWQI) program investigated seawater intrusion at different geographic areas in the Delta: in the northern Delta on the Sacramento River at Greenes Landing/Hood, in the southern Delta in the San Joaquin River near Vernalis/Mossdale, and in the western Delta at Station 9 just upstream of Clifton Court Forebay (DWR 2001b). In addition, bromide levels were monitored at Banks Pumping Plant. Bromide data were collected from 1990 to 1998 at these four locations. In the northern Delta on the Sacramento River at Greenes Landing/Hood, 98 percent of the samples collected were below the CALFED target level of 0.05 mg/L. Although the Sacramento River contributes approximately 20 percent of the total bromide loading to the Delta, in terms of concentration, bromide levels in the Sacramento River are not a concern for drinking water purposes (DWR 2001b). The seasonal changes in bromide concentrations at three locations are illustrated in Figure G-2. As shown in Figure G-2, during eight years of quarterly monitoring, the proposed CALFED target level of 0.05 mg/L bromide was exceeded only three times at Greens Landing/Hood on the Sacramento River (DWR 2001b).

In contrast to the Sacramento River, 88 percent of the samples collected in the southern Delta (San Joaquin River near Vernalis/Mossdale) and 87 percent of the samples collected in the western Delta (Station 9) exceeded CALFED's recommended target level (DWR 2001b). Because seawater contains approximately 66.8 mg/L bromide, more than 1,300 times the 0.05 mg/L export target, it takes relatively little seawater to increase bromide levels (DWR 2001b). Approximately 90 percent of the samples at the Banks Pumping Plant exceeded the proposed target (DWR 2001b).

Overall, bromide patterns in the Delta are similar to salinity patterns in the Delta (DWR 2001b). Like salinity, bromide concentrations are highest in the west and south Delta channels affected by the San Joaquin River (DWR 2001b). Like salinity, bromide concentrations are higher in dry years than in wet years and bromide concentrations are higher during low Delta outflows as compared to medium or high flows (DWR 2001b). This pattern is not unexpected as chloride and bromide are generally co-located and would be expected to exhibit similar behavior (R. Breuer, DWR, pers. comm.).



Source: DWR 2001b.

Figure G-2
Sacramento River at Greenes Landing/Hood – Monthly Average Bromide Concentrations (±1 Standard Deviation) with Sacramento River Flow

1.4 Reservoir Water Quality

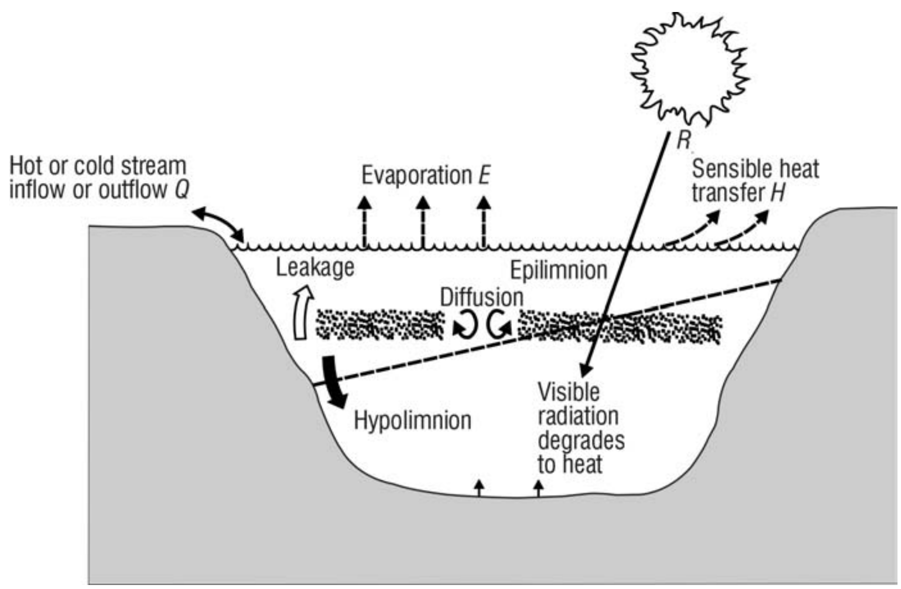
This section describes how lakes and reservoirs function, and the limnological processes that occur within them to provide a better understanding of water quality.

Physiochemical Reservoir Processes

Certain physiochemical parameters (water temperature and dissolved oxygen) associated with lakes and reservoirs typically exhibit direct relationships to depth. Because water density changes with water temperature, most waterbodies have a temperature gradient that decreases with depth. In reservoirs, warmer water generally is found near the surface and the volume of warm water tends to gradually decrease down through the water column. Conversely, a greater volume of cold water is found near the bottom of the reservoir, and this is often known as the coldwater pool (Horne, A.J. and Goldman C.R. 1994; Wetzel, R.G. 1983; Moss, B. 1998).

Because the solubility of dissolved oxygen in water is related to changes in pressure and temperature, cold water generally contains a greater percentage of dissolved oxygen as compared to warm water. However, in most systems there are additional demands that may affect this relationship. Plant and animal respiration can consume large amounts of dissolved oxygen but the major consumption of oxygen in lakes and reservoirs is attributed to bacterial respiration associated with the decomposition of organic matter settling out of the water column. Additionally, wind action across the surface of lakes promotes mixing, which generally results in greater dissolved oxygen concentrations near the surface (Horne and Goldman 1994, Wetzel 1983; Moss 1998).

<u>Summer/Winter - Stratification/Mixing</u>
In the spring and early summer, water near the lake surface begins to warm as it absorbs energy from increased solar radiation associated with longer daylight hours (Figure G-3). Because of the thermal properties associated with water, the warmer layers of water remain near the surface while denser, colder water sinks deeper into the water column. Over time, this creates distinct thermal layers (known as the epilimnion, metalimnion/thermocline and hypolimnion) within the water column. Once the spring thermocline is established, it is thermodynamically stable and usually can be destroyed only by cooling of the epilimnion. At this point, the hypolimnion is effectively isolated from the surface and dissolved oxygen cannot be replenished except by diffusion from the metalimnion, which is very slow (Horne and Goldman 1994; Wetzel 1983; Moss 1998).



Source: Horne, A.J. and Goldman C.R. 1994

Figure G-3
Horizontal Cross-Sectional View Of The Physiochemical Processes And Stratification Layers Occurring In Lakes And Reservoirs

In the fall, less solar radiation reaches the lake surface during the day, while heat losses at the surface of the water are greater at night than they are deeper in the water column. Cooling water at the surface is denser than warmer water below and so it sinks, causing the warmer water to rise up to the surface. These convective currents and wind-induced mixing begin to weaken the thermocline. The epilimnion increases in depth as water temperature decreases. Eventually the water temperature and density differences between adjacent water layers are so slight that a strong wind can overcome the remaining resistance to mixing in the water column and the lake undergoes fall overturn, mixing from top to bottom. Fall overturn causes oxygen-saturated water at the surface to be distributed throughout the various depths of the epilimnetic and hypolimnetic layers. When circulation is complete, dissolved oxygen continues at saturation in accordance with solubility at existing temperatures. These mixing events are important because they enable low or depleted oxygen stores in the hypolimnion and near the lakebed to be replenished. This also ensures that aerobic activities associated with bacterial decomposition in and above the lake sediments continue to occur. Additionally, mixing distributes organic nutrients (e.g., nitrogen and phosphorous) which are accumulated at the bottom of the lake throughout the summer, through the water column (Horne and Goldman 1994; Wetzel 1983; Moss 1998).

<u>Potential Lake Pollutants: Nutrients/Metals/Sedimentation</u>
Healthy lake ecosystems contain small quantities of nutrients from natural sources. An increased or accelerated input of nutrients (primarily nitrogen and phosphorous) may disrupt the balance of lake ecosystems by altering physical, chemical and biological processes within the system. Excessive nutrients can stimulate increased productivity, which can lead to short-term population explosions of algae and aquatic macrophytes. Eventually the algae and other vegetation die off and sink to the bottom of the lake where it undergoes bacterial decomposition. As the bacteria continue to break down the organic matter, the decomposition process elicits a high biochemical oxygen demand, which can deplete dissolved oxygen in the water. At a substantial level, this may deprive fish and other aquatic organisms of oxygen, which in turn can lead to fish kills or produce foul odors in the water (Horne and Goldman 1994; Wetzel 1983; Moss 1998).

After nutrient loading, metals are typically the second most common lake pollutant of concern and are often found to accumulate in lake sediments. These substances are a concern because many of them are harmful to humans and aquatic organisms. While many metals become concentrated in the sediment, they generally remain there unless disturbed and re-suspended in the water column. Reservoir drawdown has the potential to alter the concentration and mobility of metals found in the sediment within and around the reservoir by reducing the volume of the storage pool. Additionally, exposing a greater amount of the shoreline acreage surrounding the waterbody could potentially lead to increased shoreline erosion, which may increase the amount of sediment loading and suspended solids within the reservoir. In addition to concerns associated with metals, increased sedimentation may reduce water clarity or impair physiological mechanisms associated with aquatic organisms (Horne and Goldman 1994; Wetzel 1983; Moss 1998).

Reservoir and river management objectives may have conflicting resource goals, which require management coordination to ensure that the needs of both resources are being adequately met. In some situations, trade-offs may need to occur between the upstream reservoir and river reaches downstream. Management actions may call for increased reservoir releases to provide for downstream requirements. Providing downstream benefits (e.g., flow and habitat improvements for fish and wildlife, power generation, agricultural and municipal water diversions) from increases in reservoir flow releases may lead to reductions to reservoir storage and could negatively affect reservoir-related water quality parameters by resulting in: 1) lower surface water elevations within the reservoir; 2) reductions in the volume of the cold water pool; and 3) alteration of pollutant concentrations. Such changes to reservoir water quality could also result in direct and indirect affects to reservoir-dependent aquatic and human uses such as fisheries and primary and secondary contact recreational use.

1.5 Environmental Consequences/Environmental Impacts of the Flexible Purchase Alternative in the Upstream from the Delta Region – Detailed Discussion

The following is a detailed analysis of the effects of the Flexible Purchase Alternative in the Upstream from the Delta Region. These effects are summarized in Chapter 5 of the EWA Draft EIS/EIR. Chapter 5 also includes a complete discussion of effects to the Delta Region and Export Service Area of EWA actions.

The analysis provides a program-specific evaluation of the Flexible Purchase Alternative as compared to the Baseline Condition. The anticipated change that would occur under each scenario is compared to the significance criteria to ascertain whether the EWA Program alternative would result in "*beneficial*," "*less-than-significant*," or "*significant*" impacts on water quality.

1.5.1 Stored Reservoir Water (Including Stored Water Acquired from Crop Idling and Groundwater Substitution)

1.5.1.1 CVP/SWP Reservoirs Within the Upstream from the Delta Region

<u>Lake Shasta</u>
EWA acquisition of Sacramento River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter surface water elevation and reservoir storage in Lake Shasta, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, long-term average end-of-month water surface elevation in Lake Shasta would remain essentially equivalent to the Baseline Condition during every month of the year. The long-term average end-of-month water surface elevation in Lake Shasta would not decrease by more than 1 foot in any of the months included in the analysis. Long-term average end-of-month water surface elevation would decrease by 1 foot in August (Table G-1). Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Lake Shasta would be essentially equivalent to or greater than the Baseline Condition for 831 months of the 864 months included in the analysis. In Lake Shasta, hydrologic conditions under the Flexible Purchase Alternative would result in reductions in the end-of-month water surface elevation from the months of July and August. Reductions in the end-of-month water surface elevation would range from 5 feet in July to 4 feet in August [Appendix H, p. 181 to 192].

Table G-1
Long-term Average Lake Shasta End-of-Month Elevation Under the Baseline Condition and Flexible Purchase Alternative

Month	Average Elevation[1] (feet msl)		
	Baseline Condition	Flexible Purchase Alternative	Difference
Jan	998	998	0
Feb	1011	1011	0
Mar	1027	1027	0
Apr	1037	1037	0
May	1036	1036	0
Jun	1024	1024	0
Jul	1001	1001	0
Aug	984	983	-1
Sep	977	977	0
Oct	973	972	0
Nov	977	977	0
Dec	985	985	0

[1] Based on 72 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Lake Shasta during critical years would be essentially equivalent to or greater than the Baseline Condition for 106 months of the 132 months included in the analysis. Within critical years, the long-term average end-of-month water surface elevation in Lake Shasta would not decrease or increase in any month of the year except during July through September. Within critical years, the long-term average end-of-month water surface elevation in Lake Shasta would increase in 2 of the 11 years included in the analysis in July and in 1 of the 11 years included in the analysis in September. The long-term average end-of-month water surface elevation increase during critical years would range from 0.4 feet in July to less than 0.1 feet in September, representing a 0.05 percent and 0.01 percent increase, respectively, as compared to the Baseline Condition. Decreases within critical years would occur in 9 of the 11 years included in the analysis in July, in 11 of the 11 years included in the analysis in August, and in 6 of the 11 years in the analysis in September. The long-term average end-of-month water surface elevation decrease during critical years would range from 2.3 feet in July to 0.1 feet in September, representing a 0.26 percent to 0.01 percent decrease during that period, as compared to the Baseline Condition [Appendix H, p. 1001].

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Lake Shasta during dry years would be essentially equivalent to or greater than the Baseline Condition for 170 months of the 192 months included in the analysis. Within dry years, the long-term average end-of-month water surface elevation in Lake Shasta would not decrease or increase in any month of the year except during July through September. The increases would occur in 1 of the 16 years included in the analysis in July. The long-term average end-of-month water surface elevation increase during dry years would average 0.3 feet in July, representing up to a 0.03 percent increase, as compared to the Baseline Condition. The decreases during dry years in the long-term average end-of-month water surface elevation would occur in 9 of the 16 years included in the analysis in July, in 10 of the 16 years included in the analysis in August, and in 3 of the 16 years in the analysis in September. The long-term average end-of-month water surface elevation decrease during dry years would be up to 1 foot in July and August, and 0.1 foot in September, representing a 0.02 to 0.11 percent decrease, as compared to the Baseline Condition [Appendix H, p. 1001].

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Lake Shasta during below normal years would be essentially equivalent to or greater than the Baseline Condition for 153 months of the 168 months included in the analysis. During below normal years, the long-term average end-of-month water surface elevation in Lake Shasta would not decrease or increase in any month of the year except during July through September. The increases would occur in 2 of the 14 years included in the analysis in July, August, and September. The long-term average end-of-month water surface elevation increase during below normal years would range from 0.3 feet in July to 0.7 foot in August, representing a 0.03 percent and 0.07 percent increase, respectively, as compared to the Baseline Condition. The decreases during below normal years in the long-term average end-of-month water surface elevation would occur in 6 of the 14 years included in the analysis in July and August, and in 3 of the 14 years included in the analysis in September. The long-term average end-of-month water surface elevation decrease during below normal years would be up to 1.3 feet in both July and August, and 0.1 feet for September, representing a 0.13 percent decrease in July, a 0.07 percent decrease in August and a 0.01 percent decrease in September as compared to the Baseline Condition [Appendix H, p. 1001].

Additionally, long-term average end-of-month storage in Lake Shasta would remain essentially equivalent under the Flexible Purchase Alternative relative to the Baseline Condition. The long-term average end-of-month storage in Lake Shasta would not decrease by more than 0.6 percent in July, August, and September. Long-term average end-of-month storage would decrease by 0.6 percent in July and 0.4 percent in August (Table G-2). Under the Flexible Purchase Alternative, the end-of-month storage in Lake Shasta would be essentially equivalent to or greater than the Baseline Condition for 827 months of the 864 months included in the analysis. In Lake Shasta, hydrologic conditions under the Flexible Purchase Alternative would result in reductions in the end-of-month storage in the months of July and August. Reductions in the end-of-month storage would range from 5.9 percent in July to 4.3 percent in August [Appendix H, p. 97 to 108].

Under the Flexible Purchase Alternative, the end-of-month storage in Lake Shasta during critical years would be essentially equivalent to or greater than the Baseline Condition for 106 months of the 132 months included in the analysis. Within critical years, the long-term average end-of-month storage in Lake Shasta would not increase or decrease during any months of the year except during July through September. Within critical years, the long-term average end-of-month storage in Lake Shasta would increase in 2 of the 11 years included in the analysis in July and in 1 of the 11 years included in the analysis in September. The long-term average end-of-month storage increase during critical years would range from 4.4 thousand acre-feet (TAF) in July to 0.5 TAF in September, representing a 0.44 percent and 0.03 percent increase, respectively, as compared to the Baseline Condition. Decreases within critical years would occur in 9 of the 11 years included in the analysis in July, in 11 of the 11 years included in the analysis in August, and in 6 of the 11 years included in the analysis in September. The long-term average end-of-month storage decrease during critical years would range from 28 TAF in July to 0.5 TAF in September, representing a 2.6 percent to 0.06 percent decrease during that period, as compared to the Baseline Condition [Appendix H, p. 1000].

Table G-2
Long-term Average Lake Shasta End-of-Month Storage
Under the Baseline Condition and Flexible Purchase Alternative

Month	Average Storage[1] (TAF)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(TAF)	(%)[2]
Jan	2914	2914	0	0.0
Feb	3184	3184	0	0.0
Mar	3544	3544	0	0.0
Apr	3793	3793	0	0.0
May	3780	3780	0	0.0
Jun	3495	3495	0	0.0
Jul	3018	2999	-19	-0.6
Aug	2655	2645	-10	-0.4
Sep	2511	2510	-1	0.0
Oct	2432	2432	0	0.0
Nov	2509	2509	0	0.0
Dec	2672	2672	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the end-of-month storage in Lake Shasta during dry years would be essentially equivalent to or greater than the Baseline Condition for 170 months of the 192 months included in the analysis. Within dry years, the long-term average end-of-month storage in Lake Shasta would not decrease or increase in any month of the year except during July through September. The increases would occur in 1 of the 16 years included in the analysis in July. The long-term average end-of-month storage increase during dry years would average 5 TAF in July, representing a 0.2 percent increase, as compared to the Baseline Condition. The decreases during dry years in the long-term average end-of-month storage would occur in 9 of the 16 years included in the analysis in July, in 10 of the 16 years included in the analysis in August, and in 3 of the 16 years included in the analysis in September. The long-term average end-of-month storage decrease during dry years would range from 15 TAF in July to 2 TAF in September, representing a 0.9 percent to 0.2 percent decrease during that period, as compared to the Baseline Condition [Appendix H, p. 1000].

Under the Flexible Purchase Alternative, the end-of-month storage in Lake Shasta during below normal years would be essentially equivalent to or greater than the Baseline Condition for 153 months of the 168 months included in the analysis. During below normal years, the long-term average end-of-month storage in Lake Shasta would not decrease or increase in any month of the year except during July through September. Increases would occur in 2 of the 14 years included in the analysis in each of July, August and September. The long-term average end-of-month storage increase during below normal years would range from 14 TAF in August to 0.4 TAF in September, representing up to a 0.6 increase during July through September, as compared to the Baseline Condition. The decreases during below normal years in the long-term average end-of-month storage would occur in 6 of the 14 years included in the analysis in July and August, and in 3 of the 14 years included in the analysis in September. The long-term average end-of-month storage decrease during below normal years would range from 30 TAF in July to 1 TAF in September, representing a 1 percent to 0.05 percent decrease, during that period, as compared to the Baseline Condition [Appendix H, p. 1000].

Overall, Lake Shasta end-of-month water surface elevation and reservoir storage under the Flexible Purchase Alternative would be essentially equivalent to or greater than end-of-month water surface elevation and reservoir storage under the Baseline Condition. Additionally, end-of-month water surface elevation under the Flexible Purchase Alternative would be essentially equivalent to or greater than the end-of-month water surface elevation under the Baseline Condition in 831 months of the 864 months analyzed, and end-of-month storage under the Flexible Purchase Alternative would be essentially equivalent to or greater than the end-of-month storage under the Baseline Condition in 827 months of the 864 months analyzed. Therefore, implementation of the Flexible Purchase Alternative would not be expected to adversely affect concentrations of water quality constituents or water temperatures in Lake Shasta. As a result, any differences in water surface elevation and reservoir storage would not be expected to be of sufficient magnitude and frequency to affect water quality in such a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality in Lake Shasta would be considered less than significant.

Lake Oroville

EWA acquisition of Feather River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter surface water elevations or reservoir storage in Lake Oroville, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, the long-term average end-of-month water surface elevation in Lake Oroville would remain essentially equivalent to or greater than the Baseline Condition during most months of the year (Table G-3). In fact, the long-term average end-of-month water surface elevation in Lake Oroville would increase in May and June. Long-term average end-of-month water surface elevation would increase by 0.2 percent in May and 0.4 percent in June (Table G-3). Under the

Flexible Purchase Alternative, the end-of-month water surface elevation in Lake Oroville would be essentially equivalent to or greater than the Baseline Condition for 762 months of the 864 months included in the analysis. In Lake Oroville, hydrologic conditions under the Flexible Purchase Alternative would result in reductions in the end-of-month water surface elevation in the months of July and August. Reductions in the end-of-month water surface elevation would range from 17 feet in July to 10 feet in August [Appendix H, p. 580-591].

Table G-3
Lake Oroville End-of-Month Elevation Under the Baseline Condition and Flexible Purchase Alternative

Month	***Average Elevation[1] (feet msl)***		
	Baseline Condition	***Flexible Purchase Alternative***	***Difference***
Jan	807	807	0
Feb	824	824	0
Mar	840	840	0
Apr	857	857	0
May	864	866	2
Jun	849	852	3
Jul	825	821	-4
Aug	794	791	-3
Sep	782	782	0
Oct	775	775	0
Nov	780	780	0
Dec	791	791	0

[1] During 72 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1, Assessment Methods.

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Lake Oroville during critical years would be essentially equivalent to or greater than the Baseline Condition for 110 months of the 132 months included in the analysis. During critical years, the long-term average end-of-month water surface elevation in Lake Oroville would not decrease or increase in any month of the year except during May through September. Within critical years, the long-term average end-of-month water surface elevation in Lake Oroville would increase in 11 of the 11 years included in the analysis in May and June, in 5 of the 11 years included in the analysis in July, and in 3 of the 11 years in the analysis in September. The long-term average end-of-month water surface elevation increase during critical years would be up to 5 feet in May, 10 feet in June, 5 feet in July, and 0.1 feet in September, representing 0.6 percent, 1.3 percent, 0.7 percent, and 0.02 percent increase, respectively, as compared to the Baseline Condition. The decreases during critical years in the long-term average end-of-month water surface elevation would occur in 6 of the 11 years included in the analysis in July, in 11 of the 11 years included in the analysis in August, and in 5 of the 11 years included in the analysis in September. The long-term average end-of-month water surface elevation decrease during critical years would range from 7 feet in July to 1 foot in September, representing a 1 percent to 0.2 percent decrease during that period, as compared to the Baseline Condition [Appendix H, p. 1005].

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Lake Oroville during dry years would be essentially equivalent to or greater than the Baseline Condition for 162 months of the 192 months included in the analysis. Within dry years, the long-term average end-of-month water surface elevation in Lake Oroville would not decrease or increase in any month of the year except May through September. The increases would occur in 10 of the 16 years included in the analysis in May and June, in 6 of the 16 years included in the analysis in July, and in 3 of the 16 years included in the analysis in September. The long-term average end-of-month water surface elevation increase during dry years would be up to 3 feet in May, 6 feet in June, 5 feet in July, and 0.1 feet in September, representing a 0.3 percent, 0.7 percent, 0.6 percent, and 0.01 percent increase, respectively, as compared to the Baseline Condition. The decreases during dry years in the long-term average end-of-month water surface elevation would occur in 10 of the 16 years included in the analysis in July, in 16 of the 16 years included in the analysis in August and in 4 of the 16 years included in the analysis in September. The long-term average end-of-month water surface elevation decrease during dry years would range from 5 feet in July, to 0.4 feet in September, representing a 0.6 percent to 0.06 percent decrease during that period, as compared to the Baseline Condition [Appendix H, p. 1005].

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Lake Oroville during below normal years would be essentially equivalent to or greater than the Baseline Condition for 134 months of the 168 months included in the analysis. During below normal years, the long-term average end-of-month water surface elevation in Lake Oroville would not decrease or increase in any month of the year except during May through September. The increases would occur in 6 of the 14 years included in the analysis in May and in 7 of the 14 years included in the analysis in June. The long-term average end-of-month water surface elevation increase during below normal years would range from 1 foot in May to 3 feet in June, representing a 0.2 percent and 0.3 percent increase, respectively, as compared to the Baseline Condition. The decreases during below normal years in the long-term average end-of-month water surface elevation would occur in 14 of the 14 years included in the analysis in July, in 11 of the 14 years included in the analysis in August, and in 7 of the 14 years included in the analysis in September. The long-term average end-of-month water surface elevation decrease during below normal years would range from 4 feet in July to 0.3 feet in September, representing a 0.5 percent to 0.04 percent decrease, during that period, as compared to the Baseline Condition [Appendix H, p. 1005].

Long-term average end-of-month storage in Lake Oroville under the Flexible Purchase Alternative would remain essentially equivalent to or greater than the Baseline Condition during most months of the year. The long-term average end-of-month storage in Lake Oroville would increase in May and June and decrease in July, August, and September. Long-term average end-of-month storage would increase by 0.6 percent in May and 1.4 percent in June and decrease by 2.0 percent in July, 1.2 percent in August, and 0.1 percent in September (Table G-4). Under the Flexible Purchase Alternative, the end-of-month storage in Lake Oroville would be essentially equivalent to or greater than the Baseline Condition for 771 months of the 864 months included in the analysis. In Lake Oroville, hydrologic conditions under the Flexible Purchase Alternative would result in reductions in the end-of-month storage in the months of July, August, and September. Reductions in the end-of-month storage would be 9.3 percent in July, 6.1 percent in August, and 4.1 percent in September [Appendix H, p. 121-132].

Under the Flexible Purchase Alternative, the end-of-month storage in Lake Oroville during critical years would be essentially equivalent to or greater than the Baseline Condition for 110 months of the 132 months included in the analysis. Within critical years, the long-term average end-of-month storage in Lake Oroville would not decrease or increase in any month of the year except during May through September. Within critical years, the long-term average end-of-month storage in Lake Oroville would increase in 11 of the 11 years included in the analysis in May and June, in 5 of the 11 years included in the analysis in July, and in 3 of the 11 years included in the analysis in September. The long-term average end-of-month storage increase during critical years would range from 43 TAF in May, 92 TAF in June, 41 TAF in July, to 1 TAF in September, representing a 2.4 percent, 6.0 percent, 2.6 percent, and 0.1 percent increase, respectively, as compared to the Baseline Condition. The decreases during critical years in the long-term average end-of-month storage would occur in 6 of the 11 years included in the analysis in July, in 11 of the 11 years included in the analysis in August, and in 5 of the 11 years included in the analysis in September. The long-term average end-of-month storage decrease during critical years would range from 52 TAF in July to 3 TAF in September, representing a 4 percent to 1 percent decrease, during that period, as compared to the Baseline Condition [Appendix H, p. 1004].

Table G-4
Long-term Average Lake Oroville End of Month Storage Under the Baseline Condition and Flexible Purchase Alternative

	Average Storage[1] (TAF)		Difference	
Month	Baseline Condition	Flexible Purchase Alternative	(TAF)	(%)[2]
Jan	2350	2350	0	0.0
Feb	2525	2525	0	0.0
Mar	2704	2704	0	0.0
Apr	2953	2953	0	0.0
May	3056	3073	17	0.6
Jun	2849	2888	39	1.4
Jul	2557	2507	-50	-2.0
Aug	2218	2192	-26	-1.2
Sep	2105	2103	-2	-0.1
Oct	2047	2047	0	0.0
Nov	2099	2099	0	0.0
Dec	2199	2199	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the end-of-month storage in Lake Oroville during dry years would be essentially equivalent to or greater than the Baseline Condition for 158 months of the 192 months included in the analysis. Within dry years, the long-term average end-of-month storage in Lake Oroville would not decrease or increase in any month of the year except during May through September. The increases would occur in 10 of the 16 years included in the analysis in May and June, in 6 of the 16 years included in the analysis in July, and in 3 of the 16 years included in the analysis in September. The long-term average end-of-month storage increase during dry years would range from 37 TAF in May, 77 TAF in June, 52 TAF in July, to 1 TAF in September, representing a 1.4 percent, 3.1 percent, 2.5 percent, and 0.1 percent increase, respectively, as compared to the Baseline Condition. The decreases during dry years in the long-term average end-of-month storage would occur in 10 of the 16 years included in the analysis in July, in 16 of the 16 years included in the analysis in August, and in 4 of the 16 years included in the analysis in September. The long-term average end-of-month storage decrease during dry years would range from 50 TAF in July to 4 TAF in September, representing a 2.3 percent to 0.3 percent decrease, during that period, as compared to the Baseline Condition [Appendix H, p. 1004].

Under the Flexible Purchase Alternative, the end-of-month storage in Lake Oroville during below normal years would be essentially equivalent to or greater than the Baseline Condition for 136 months of the 168 months included in the analysis. During below normal years, the long-term average end-of-month storage in Lake Oroville would not decrease or increase in any month of the year except during May through September. The increases would occur in 6 of the 14 years included in the analysis in May and in 7 of the 14 years included in the analysis in June. The long-term average end-of-storage increase during below normal years would range from 20 TAF in May to 40 TAF in June, representing a 0.6 percent and 1.3 percent increase, respectively, as compared to the Baseline Condition. The decreases during below normal years in the long-term average end-of-month storage would occur in 14 of the 14 years included in the analysis in July and 11 of the 14 years included in the analysis in August and in 7 of the 14 years included in the analysis in September. The long-term average end-of-month storage decrease during below normal years would range from 53 TAF in July to 3 TAF in September, representing a 2.1 percent to 0.2 percent decrease, during that period, as compared to the Baseline Condition [Appendix H, p. 1004].

Overall, Lake Oroville end-of-month water surface elevation and reservoir storage under the Flexible Purchase Alternative would not be substantially less than end-of-month water surface elevation and reservoir storage under the Baseline Condition. Additionally, end-of-month water surface elevation under the Flexible Purchase Alternative would be essentially equivalent to or greater than the end-of-month water surface elevation under the Baseline Condition in 762 months of the 864 months analyzed, and end-of-month storage under the Flexible Purchase Alternative would be essentially equivalent to or greater than the end-of-month storage under the Baseline Condition in 771 months of the 864 months analyzed. Therefore, implementation of the Flexible Purchase Alternative would not be expected to adversely affect concentrations of water quality constituents or water temperatures in Lake Oroville. As a result, any differences in water surface elevation and reservoir storage would not be expected to be of sufficient magnitude and frequency to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be considered less than significant.

Folsom Reservoir

EWA acquisition of American River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter surface water elevation and reservoir storage in Folsom Reservoir, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, the long-term average end-of-month water surface elevation in Folsom Reservoir would remain essentially equivalent to the Baseline Condition during every month of the year. Long-term average end-of-month water surface elevation would decrease by 1 foot in July and 1 foot in August (Table G-5). Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Folsom Reservoir would be essentially equivalent to or greater than the Baseline Condition for 863 months of the 864 months included in the analysis. In Folsom Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reductions in the end-of-month water surface elevation in the month of July. The greatest reductions in the end-of-month water surface elevation would be 2 feet in July [Appendix H, p. 193-204].

Table G-5
Long-term Average Folsom Reservoir End-of-Month Elevation Under the Baseline Condition and Flexible Purchase Alternative

Month	Average Elevation[1] (feet msl)		
	Baseline Condition	Flexible Purchase Alternative	Difference
Jan	411	411	0
Feb	414	414	0
Mar	425	425	0
Apr	438	438	0
May	449	449	0
Jun	444	444	0
Jul	428	427	-1
Aug	421	420	-1
Sep	411	411	0
Oct	409	409	0
Nov	407	407	0
Dec	408	408	0

[1] Based on 72 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Folsom Reservoir during critical years would be essentially equivalent to or greater than the Baseline Condition for 110 months of the 132 months included in the analysis. During critical years, the long-term average end-of-month water surface elevation in Folsom Reservoir would not increase during any month of the year and would decrease during July and August. Within critical years, the long-term average end-of-month water surface elevation in Folsom Reservoir would decrease in 11 of the 11 years included in the analysis in July and in August. The long-term average end-of-month water surface elevation decrease during critical years would be 1 foot in July and in August, representing a 0.2 percent decrease, each, as compared to the Baseline Condition [Appendix H, p. 1003].

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Folsom Reservoir during dry years would be essentially equivalent to or greater than the Baseline Condition for 160 months of the 192 months included in the analysis. Within dry years, the long-term average end-of-month water surface elevation in Folsom Reservoir would not increase in any month of the year and would decrease during July and August. The decreases would occur in 16 of the 16 years included in the analysis in July and in August. The long-term average end-of-month water surface elevation decrease during dry years would be 0.3 feet in July and 0.4 feet in August, representing a 0.1 percent decrease each, as compared to the Baseline Condition [Appendix H, p. 1003].

Under the Flexible Purchase Alternative, the end-of-month water surface elevation in Folsom Reservoir during below normal years would be essentially equivalent to or greater than the Baseline Condition for 140 months of the 168 months included in the analysis. During below normal years, the long-term average end-of-month water surface elevation in Folsom Reservoir would not increase in any month of the year and would decrease during July and August. The decreases would occur in 14 of the 14 years included in the analysis in July and in August. The long-term average end-of-month water surface elevation decrease during below normal years would be 0.4 feet in July and in August, representing a 0.1 percent decrease each, as compared to the Baseline Condition [Appendix H, p. 1003].

Additionally, long-term average end-of-month storage in Folsom Reservoir would remain essentially equivalent under the Flexible Purchase Alternative relative to the Baseline Condition. Long-term average end-of-month storage would decrease by 0.6 percent in July and 0.5 percent in August (Table G-6). Under the Flexible Purchase Alternative, the end-of-month storage in Folsom Reservoir would be essentially equivalent to or greater than the Baseline Condition for 851 months of the 864 months included in the analysis. In Folsom Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reductions in the end-of-month storage from the months of July and August. Reductions in the end-of-month storage would range from 6 feet in July to 4 feet in August [Appendix H, p. 109-120].

Table G-6 Long-term Average Folsom Reservoir End-of-Month Storage Under the Baseline Condition and Flexible Purchase Alternative				
	Average Storage[1] (TAF)		Difference	
Month	Baseline Condition	Flexible Purchase Alternative	(TAF)	(%)[2]
Jan	473	473	0	0.0
Feb	495	495	0	0.0
Mar	584	584	0	0.0
Apr	703	703	0	0.0
May	815	815	0	0.0
Jun	769	769	0	0.0
Jul	626	622	-4	-0.6
Aug	568	565	-3	-0.5
Sep	488	488	0	0.0
Oct	469	469	0	0.0
Nov	451	451	0	0.0
Dec	457	457	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the end-of-month storage in Folsom Reservoir during critical years would be essentially equivalent to or greater than the Baseline Condition for 110 months of the 132 months included in the analysis. Within critical years, the long-term average end-of-month storage in Folsom Reservoir would not increase in any month of the year and would decrease during July and August. Within critical years, the long-term average end-of-month storage in Folsom Reservoir would decrease in 11 of the 11 years included in the analysis in July and in August. The long-term average end-of-month storage decrease during critical years would be 3 TAF in July and in August, representing a 1 percent decrease each, as compared to the Baseline Condition [Appendix H, p. 1002].

Under the Flexible Purchase Alternative, the end-of-month storage in Folsom Reservoir during dry years would be essentially equivalent to or greater than the Baseline Condition for 160 months of the 192 months included in the analysis. Within dry years, the long-term average end-of-month storage in Folsom Reservoir would not increase in any month of the year and would decrease during July and August. The decreases would occur in 16 of the 16 years included in the analysis in July and in August. The long-term average end-of-month storage decrease during dry years would be 2 TAF in July and 3 TAF in August, representing a 0.5 percent and 0.8 percent decrease, respectively, as compared to the Baseline Condition [Appendix H, p. 1002].

Under the Flexible Purchase Alternative, the end-of-month storage in Folsom Reservoir during below normal years would be essentially equivalent to or greater than the Baseline Condition for 140 months of the 168 months included in the analysis. During below normal years, the long-term average end-of-month storage in Folsom Reservoir would not increase in any month of the year and would decrease during July and August. The decreases would occur in 14 of the 14 years included in the analysis in July and in August. The long-term average end-of-month decrease during below normal years would be 4 TAF in July and 3 TAF in August, representing a 0.6 percent decrease each, as compared to the Baseline Condition [Appendix H, p. 1002].

Overall, Folsom Reservoir end-of-month water surface elevation and reservoir storage under the Flexible Purchase Alternative would be essentially equivalent to or greater than end-of-month water surface elevation and reservoir storage under the Baseline Condition. Additionally, end-of-month water surface elevation under the Flexible Purchase Alternative would be essentially equivalent to or great than the end-of-month water surface elevation under the Baseline Condition in 863 months of the 864 months analyzed, and end-of-month storage under the Flexible Purchase Alternative would be essentially equivalent to or great than the end-of-month storage under the Baseline Condition in 851 months of the 864 months analyzed. Therefore, implementation of the Flexible Purchase Alternative would not be expected to adversely affect concentrations of water quality constituents or water temperatures in Folsom Reservoir. As a result, any differences in water surface elevation and reservoir storage would not be expected to be of sufficient magnitude and frequency to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be considered less than significant.

1.5.1.2 Non-Project Reservoirs Within the Upstream from the Delta Region

<u>Little Grass Valley and Sly Creek Reservoirs</u>
EWA acquisition of OWID stored reservoir water would reduce surface water elevation and reservoir storage in Little Grass Valley and Sly Creek reservoirs, relative to the Baseline Condition.

Table G-7 provides monthly median reservoir storage and water surface elevation for Little Grass Valley Reservoirs. In Little Grass Valley Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage for the months of November through April as compared to the Baseline Condition. Reductions in median reservoir storage would range from 3 percent in April to 24 percent in December under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative would result in reduction of the median water surface elevation for the months of November through April as compared to the Baseline Condition. Reductions in median water surface elevation would range from 2 feet in April to 12 feet in December under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-7 ***Little Grass Valley Reservoir Monthly Median Storage, and Water Surface Elevation Under the Baseline Condition and Flexible Purchase Alternative***							
	Storage				***Elevation***		
Month	***Baseline Condition (TAF)***	***Flexible Purchase Alternative (TAF)***	***Diff (TAF)***	***Diff (%)***	***Baseline Condition (ft msl)***	***Flexible Purchase Alternative (ft msl)***	***Diff (ft msl)***
Oct	52	52	0	0	5018	5018	0
Nov	50	44	-6	-12	5015	5010	-6
Dec	50	38	-12	-24	5016	5004	-12
Jan	57	48	-10	-17	5022	5013	-9
Feb	63	55	-7	-11	5027	5021	-6
Mar	70	65	-5	-7	5033	5029	-4
Apr	76	73	-2	-3	5037	5035	-2
May	86	86	0	0	5044	5044	0
Jun	86	86	0	0	5044	5044	0
Jul	76	76	0	0	5037	5037	0
Aug	66	66	0	0	5029	5029	0
Sep	58	58	0	0	5023	5023	0

Based on median monthly storage and flow over the historical record from 1970 to 2001.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

The monthly median storage and water surface elevation for Little Grass Valley Reservoir during critical and dry and below normal years are provided in Tables G-8 and G-9, respectively. In Little Grass Valley Reservoir, hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of median reservoir storage from the months of November through April as compared to the Baseline Condition. Reductions in median reservoir storage during critical years would range from 3 percent in April to 24 percent in December under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of the median water surface elevation from the months of November through April as compared to the Baseline Condition. Reductions in median water surface elevation during critical years would range from 2 feet in April to 12 feet in December under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-8 Little Grass Valley Reservoir Monthly Median Storage, Elevation, Elevation Change, and Release Under the Baseline Condition and Flexible Purchase Alternative During Critical Years							
	Storage				Elevation		
Month	Baseline Condition (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%))	Baseline Condition (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	51	51	0	0	5016	5016	0
Nov	50	44	-6	-12	5016	5010	-6
Dec	48	36	-12	-24	5014	5002	-12
Jan	44	35	-10	-17	5010	5000	-10
Feb	47	40	-7	-11	5013	5006	-7
Mar	52	47	-5	-7	5018	5013	-4
Apr	60	57	-2	-3	5024	5022	-2
May	67	76	0	0	5030	5030	0
Jun	67	67	0	0	5030	5030	0
Jul	65	65	0	0	5029	5029	0
Aug	61	61	0	0	5025	5025	0
Sep	57	57	0	0	5022	5022	0

Based on median monthly storage and flow over the historical record from 1970 to 2001. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table G-9 Little Grass Valley Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative During Dry and Below Normal Years							
	Storage				Elevation		
Month	Baseline Condition (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	52	52	0	0	5018	5018	0
Nov	50	44	-6	-12	5015	5010	-6
Dec	49	37	-12	-24	5015	5002	-12
Jan	50	40	-10	-17	5015	5006	-9
Feb	55	47	-7	-11	5020	5013	-7
Mar	67	62	-5	-7	5030	5026	-4
Apr	76	74	-2	-3	5037	5035	-2
May	81	81	0	0	5040	5040	0
Jun	80	80	0	0	5040	5040	0
Jul	74	74	0	0	5035	5035	0
Aug	66	66	0	0	5029	5029	0
Sep	60	60	0	0	5025	5025	0

Based on median monthly storage and flow over the historical record from 1970 to 2001. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of median reservoir storage from the months of November through April as compared to the Baseline Condition. Reductions in median reservoir storage during dry and below normal years would range from 3 percent in April to 24 percent in December under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of the median water surface elevation for the months of November through April as compared to the Baseline Condition. Reductions in median water surface elevation during dry and below normal years would range from 2 feet in April to 12 feet in December under the Flexible Purchase Alternative relative to the Baseline Condition.

In Sly Creek Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage from the months of November through April as compared to the Baseline Condition (Table G-10). Reductions in median reservoir storage would range from 2 percent in April to 27 percent in December under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative would result in reduction of the median water surface elevation from the months of November through April as compared to the Baseline Condition. Reductions in median water surface elevation would range from 2 feet in April to 18 feet in December under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-10
Sly Creek Reservoir Monthly Median Storage and Elevation
Under the Baseline Condition and Flexible Purchase Alternative

	Storage				Elevation		
Month	**Baseline Condition (TAF)**	**Flexible Purchase Alternative (TAF)**	**Diff (TAF)**	**Diff (%)**	**Baseline Condition (ft msl)**	**Flexible Purchase Alternative (ft msl)**	**Diff (ft msl)**
Oct	22	22	0	0	3438	3438	0
Nov	21	18	-3	-12	3434	3425	-8
Dec	19	14	-5	-27	3427	3410	-18
Jan	27	23	-4	-15	3453	3441	-12
Feb	36	33	-3	-8	3476	3468	-8
Mar	48	46	-2	-4	3504	3500	-4
Apr	55	54	-1	-2	3521	3519	-2
May	62	62	0	0	3536	3536	0
Jun	58	58	0	0	3525	3525	0
Jul	48	48	0	0	3504	3504	0
Aug	33	33	0	0	3469	3469	0
Sep	25	25	0	0	3447	3447	0

Based on median monthly storage and flow over the historical record from 1970 to 2001. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

The monthly median storage and water surface elevation for Sly Creek Reservoir during critical and dry and below normal years are provided in Tables G-11 and G-12, respectively. In Sly Creek Reservoir, hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of median reservoir storage from the months of November through April as compared to the Baseline Condition. Reductions in median reservoir storage during critical years would range from 2 percent in April to 27 percent in December under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of the median water surface elevation from the months of November through April as compared to the Baseline Condition. Reductions in median water surface elevation during critical years would range from 2 feet in April to 18 feet in December under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-11 Sly Creek Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative During Critical Years							
	Storage				Elevation		
Month	Baseline Condition (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	28	28	0	0	3455	3455	0
Nov	19	17	-3	-12	3429	3421	-8
Dec	18	13	-5	-27	3425	3407	-18
Jan	18	14	-4	-15	3426	3412	-14
Feb	22	19	-3	-8	3437	3427	-10
Mar	36	34	-2	-4	3476	3471	-5
Apr	55	54	-1	-2	3520	3518	-2
May	58	58	0	0	3527	3527	0
Jun	48	48	0	0	3505	3505	0
Jul	38	38	0	0	3482	3482	0
Aug	28	28	0	0	3455	3455	0
Sep	23	23	0	0	3439	3439	0

Based on median monthly storage and flow over the historical record from 1970 to 2001. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table G-12 Sly Creek Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative During Dry and Below Normal Years							
	Storage				Elevation		
Month	No Action/ No Project Alternative (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%)	No Action/ No Project Alternative (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	19	19	0	0	3427	3427	0
Nov	15	12	-3	-12	3412	3403	-9
Dec	10	5	-5	-27	3395	3374	-21
Jan	14	10	-4	-15	3409	3394	-15
Feb	21	18	-3	-8	3435	3425	-10
Mar	36	34	-2	-4	3477	3472	-5
Apr	57	56	-1	-2	3523	3521	-2
May	62	62	0	0	3536	3536	0
Jun	57	57	0	0	3524	3524	0
Jul	46	46	0	0	3500	3500	0
Aug	37	37	0	0	3480	3480	0
Sep	33	33	0	0	3470	3470	0

Based on median monthly storage and flow over the historical record from 1970 to 2001. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of median reservoir storage for the months of November through April as compared to the Baseline Condition. Reductions in median reservoir storage during dry and below normal years would range from 2 percent in April to 27 percent in December under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of the median water surface elevation for the months of November through April as compared to the Baseline Condition. Reductions in median water surface elevation during dry and below normal years would range from 2 feet in April to 21 feet in December under the Flexible Purchase Alternative relative to the Baseline Condition.

Overall, median water surface elevation and median reservoir storage under the Flexible Purchase Alternative would be decreased from November to April as compared to the Baseline Condition. Water temperatures during these months of the year would be expected to be at their lowest points during the annual cycle, and therefore the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into these reservoirs, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, any differences in median water surface elevation and reservoir storage would not be expected to be of sufficient magnitude and frequency to affect long-term water quality in such a way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be considered less than significant.

<u>New Bullards Bar Reservoir</u>
EWA acquisition of Yuba County Water Agency via stored reservoir water and groundwater substitution would alter surface water elevation and reservoir storage in New Bullards Bar Reservoir, relative to the Baseline Condition.

Table G-13 provides monthly median reservoir storage and water surface elevation for New Bullards Bar Reservoir. In New Bullards Bar Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage from the months of July through January as compared to the Baseline Condition. Reductions in median reservoir storage would range from 1 percent in July to 18 percent in October and November under the Flexible Purchase Alternative relative to the Baseline Condition. Additionally, median reservoir storage would increase by up to 5 percent between April and June. Hydrologic conditions under the Flexible Purchase Alternative would result in reduction of the median water surface elevation from the months of July through January as compared to the Baseline Condition. Reductions in median water surface elevation would range from 1 foot in July to 27 feet in October under the Flexible Purchase Alternative relative to the Baseline Condition. Additionally, median water surface elevation would increase by up to 5 feet between April and June.

Table G-13 New Bullards Bar Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative							
	Storage				Elevation		
Month	Baseline Condition (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	544	446	-98	-18	1838	1812	-27
Nov	546	449	-98	-18	1839	1812	-26
Dec	532	442	-90	-17	1835	1810	-25
Jan	593	578	-15	-3	1850	1847	-3
Feb	649	649	0	0	1862	1862	0
Mar	735	735	0	0	1878	1878	0
Apr	774	788	14	2	1884	1886	2
May	879	908	28	3	1899	1902	3
Jun	917	960	43	5	1903	1908	5
Jul	825	820	-5	-1	1892	1891	-1
Aug	713	660	-52	-7	1874	1864	-10
Sep	614	514	-100	-16	1855	1831	-24

Based on median monthly storage and flow over the historical record from 1970 to 2001. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Monthly median reservoir storage and water surface elevation for New Bullards Bar Reservoir during critical and dry and below normal years are provided in Table G-14 and Table G-15, respectively. In New Bullards Bar Reservoir, hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of median reservoir storage from the months of July through December as compared to the Baseline Condition. Reductions in median reservoir storage during critical years would range from 0.8 percent in July to 19 percent in September under the Flexible Purchase Alternative relative to the Baseline Condition. Additionally, median reservoir storage during critical years would increase by up to 7 percent in June. Hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of the median water surface elevation from the months of July through December as compared to the Baseline Condition. Reductions in median water surface elevation during critical years would range from 1 foot in July to 28 feet in September under the Flexible Purchase Alternative relative to the Baseline Condition. Additionally, median water surface elevation during critical years would increase by up to 8 feet in June.

Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of median reservoir storage from the months of July through January as compared to the Baseline Condition. Reductions in median reservoir storage during dry and below normal years would range from 0.6 percent in July to 17 percent in September under the Flexible Purchase Alternative relative to the Baseline Condition. Additionally, median reservoir storage during dry and below normal years would increase by up to 5 percent in June. Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of the median water surface elevation from the months of July through January as compared to the Baseline Condition. Reductions in median water surface elevation during dry and below normal years would range from 1 foot in July to 25 feet in September under the Flexible Purchase Alternative relative to the Baseline Condition. Additionally, median water surface elevation during dry and below normal years would increase by up to 6 feet in June.

Table G-14
New Bullards Bar Reservoir Monthly Median Storage, Elevation, Elevation Change, and Release Under the Baseline Condition and Flexible Purchase Alternative During Critical Years

Month	Storage				Elevation		
	Baseline Condition (TAF)	Flexible Purchase Alternative (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	Flexible Purchase Alternative (ft msl)	Diff (ft msl)
Oct	584	523	-62	-11	1848	1833	-15
Nov	562	518	-44	-8	1843	1832	-11
Dec	555	532	-23	-4	`841	1835	-6
Jan	519	519	0	0	1832	1832	0
Feb	546	546	0	0	1839	1839	0
Mar	640	640	0	0	1860	1860	0
Apr	714	728	14	2	1874	1877	2
May	681	709	28	4	1868	1874	5
Jun	634	677	43	7	1859	1868	8
Jul	589	584	-5	-0.8	1849	1848	-1
Aug	547	495	-52	-10	1839	1826	-14
Sep	534	434	-100	-19	1836	1808	-28

Based on median monthly storage and flow over the historical record from 1970 to 2001 Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table G-15
New Bullards Bar Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative During Dry and Below Normal Years

Month	Storage				Elevation		
	Baseline Condition (TAF)	FPA (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	FPA (ft msl)	Diff (ft msl)
Oct	522	459	-63	-12	1833	1815	-17
Nov	485	443	-43	-9	1823	1811	-12
Dec	445	425	-20	-4	1811	1805	-6
Jan	436	431	-5	-1	1809	1807	-2
Feb	460	460	0	0	1816	1816	0
Mar	615	615	0	0	1855	1855	0
Apr	762	776	14	2	1882	1885	3
May	811	840	28	3	1890	1894	4
Jun	772	814	43	5	1884	1890	6
Jul	733	728	-5	-0.6	1878	1877	-1
Aug	648	596	-52	-8	1862	1851	-11
Sep	595	495	-100	-17	1850	1826	-25

Based on median monthly storage and flow over the historical record from 1970 to 2001 Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, median water surface elevation and median reservoir storage under the Flexible Purchase Alternative would be decreased from July to January, but would increase from April through June as compared to the Baseline Condition. Water temperatures during the months of greatest reductions (September through

December) would be expected to be low enough that the decrease in median reservoir storage and water surface elevation would not cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into this reservoir, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, any differences in median water surface elevation and reservoir storage would not be expected to be of sufficient magnitude and frequency to affect long-term water quality in such as way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be considered less than significant.

<u>French Meadows and Hell Hole Reservoirs</u>
EWA acquisition of Placer County Water Agency-stored reservoir water would decrease surface water elevation and reservoir storage in French Meadows and Hell Hole reservoirs, relative to the Baseline Condition.

Table G-16 provides monthly median reservoir storage and water surface elevation for French Meadows Reservoir. In French Meadows Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage from the months of July through January as compared to the Baseline Condition. Reductions in median reservoir storage would range from 2 percent in July to 12 percent in October under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative would result in reduction of the median water surface elevation from the months of July through January as compared to the Baseline Condition. Reductions in median water surface elevation would range from 2 feet in July to 8 feet in October under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-16 French Meadows Reservoir Monthly Median Storage, Elevation and Flow Below Ralston Afterbay Under the Baseline Condition and Flexible Purchase Alternative												
	Storage				Elevation			Median Flow Below Ralston (1974-2001)				
Month	Baseline Condition (TAF)	FPA (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	FPA (ft msl)	Diff (ft msl)	Base Cond. (cfs)	FPA (cfs)	Diff (cfs)	Diff (%)
Oct	67	59	-8	-12	5205	5197	-8	258	258	0	0
Nov	59	57	-3	-5	5197	5194	-3	488	275	-213	-43.6
Dec	56	53	-3	-5	5193	5189	-3	265	265	0	0
Jan	61	58	-2	-4	5198	5196	-3	281	266	-15	-5.3
Feb	61	61	0	0	5199	5199	0	437	325	-112	-25.6
Mar	75	75	0	0	5213	5213	0	615	615	0	0
Apr	93	93	0	0	5229	5229	0	554	554	0	0
May	116	116	0	0	5246	5246	0	656	656	0	0
Jun	129	129	0	0	5256	5256	0	631	698	67	10.7
Jul	113	111	-3	-2	5244	5242	-2	629	736	107	17.1
Aug	100	94	-5	-5	5234	5230	-4	666	773	107	16.1
Sep	82	74	-8	-9	5219	5212	-7	456	500	44	9.6

Based on median monthly storage and flow over the historical record from 1974 to 2001 with a maximum 20 TAF EWA Action on French Meadows and Hell Hole Reservoirs combined.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Monthly median reservoir storage and water surface elevation for French Meadows during critical and dry and below normal years are provided in Table G-17 and Table G-18, respectively. In French Meadows Reservoir, hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of median reservoir storage during the months of July through October as compared to the Baseline Condition. Reductions in median reservoir storage during critical years would range from 4 percent in July to 19 percent in September under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of the median water surface elevation from the months of July through October as compared to the Baseline Condition. Reductions in median water surface elevation during critical years would range from 2 feet in October to 11 feet in September under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-17 French Meadows Reservoir Monthly Median Storage, Elevation and Flow Below Ralston Afterbay Under the Baseline Condition and Flexible Purchase Alternative During Critical years											
	Storage				Elevation			Median Flow Below Ralston (1974-2001)			
Month	Baseline Condition (TAF)	FPA (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	FPA (ft msl)	Diff (ft msl)	Baseline Condition (cfs)	FPA (cfs)	Diff (cfs)	Diff (%)
Oct	55	53	-2	-4	5192	5190	-2	324	59	-265	-81.9
Nov	55	55	0	0	5192	5192	0	305	246	-59	-19.2
Dec	55	55	0	0	5193	5193	0	76	76	0	0
Jan	56	56	0	0	5194	5194	0	87	87	0	0
Feb	55	55	0	0	5192	5192	0	63	63	0	0
Mar	51	51	0	0	5187	5187	0	81	81	0	0
Apr	70	70	0	0	5208	5208	0	31	31	0	0
May	88	88	0	0	5225	5225	0	82	82	0	0
Jun	88	88	0	0	5224	5224	0	328	395	67	20.5
Jul	70	67	-3	-4	5208	5205	-3	456	563	107	23.5
Aug	51	46	-5	-10	5187	5181	-6	391	498	107	27.5
Sep	41	33	-8	-19	5175	5164	-11	328	372	44	13.3

Based on median monthly storage and flow over the historical record from 1974 to 2001 with a maximum 20 TAF EWA Action on French Meadows and Hell Hole Reservoirs combined.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table G-18 French Meadows Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative During Dry and Below Normal Years											
	Storage				Elevation			Median Flow Below Ralston (1974-2001)			
Month	Baseline Condition (TAF)	FPA (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	FPA (ft msl)	Diff (ft msl)	Baseline Condition (cfs)	FPA (cfs)	Diff (cfs)	Diff (%)
Oct	67	59	-8	-12	5202	5197	-8	164	164	0	0
Nov	62	62	0	0	5200	5200	0	551	218	-333	-60.4
Dec	58	58	0	0	5196	5196	0	305	305	0	0
Jan	57	57	0	0	5194	5194	0	301	301	0	0
Feb	59	59	0	0	5196	5196	0	236	236	0	0
Mar	72	72	0	0	5210	5210	0	208	208	0	0
Apr	98	98	0	0	5232	5232	0	208	208	0	0
May	110	110	0	0	5242	5242	0	232	232	0	0
Jun	112	112	0	0	5243	5243	0	408	408	67	16.5
Jul	101	98	-3	-3	5235	5233	-2	505	547	107	21.3
Aug	91	85	-5	-5	5227	5222	-4	592	634	107	18.1
Sep	80	72	-8	-10	5218	5211	-7	437	481	44	10.0

Based on median monthly storage and flow over the historical record from 1974 to 2001 with a maximum 20 TAF EWA Action on French Meadows and Hell Hole Reservoirs combined.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of median reservoir storage from the months of July through October as compared to the Baseline Condition. Reductions in median reservoir storage during dry and below normal years would range from 3 percent in July to 12 percent in October under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of the median water surface elevation from the months of July through October as compared to the Baseline Condition. Reductions in median water surface elevation during dry and below normal years would range from 2 feet in July to 8 feet in October under the Flexible Purchase Alternative relative to the Baseline Condition.

In Hell Hole Reservoir, hydrologic conditions under the Flexible Purchase Alternative would result in reduction of median reservoir storage from the months of June through January as compared to the Baseline Condition (Table G-19). Reductions in median reservoir storage would range from 2 percent in June to 10 percent in September and October under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative would result in reduction of the median water surface elevation from the months of June through January as compared to the Baseline Condition. Reductions in median water surface elevation would range from 5 feet in June to 15 feet in September and October under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-19
Hell Hole Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative

	Storage				Elevation		
Month	**Baseline Condition (TAF)**	**FPA (TAF)**	**Diff (TAF)**	**Diff (%)**	**Baseline Condition (ft msl)**	**FPA (ft msl)**	**Diff (ft msl)**
Oct	120	108	-12	-10	4555	4540	-15
Nov	110	106	-4	-4	4542	4536	-6
Dec	104	100	-4	-4	4534	4528	-6
Jan	102	98	-4	-4	4531	4525	-5
Feb	104	104	0	0	4533	4533	0
Mar	110	110	0	0	4542	4542	0
Apr	140	140	0	0	4578	4578	0
May	173	173	0	0	4616	4616	0
Jun	191	187	-4	-2	4637	4632	-5
Jul	168	160	-8	-5	4610	4601	-9
Aug	136	124	-12	-9	4573	4559	-14
Sep	121	109	-12	-10	4555	4540	-15

Based on median monthly storage and flow over the historical record from 1974 to 2001 with a maximum 20 TAF EWA Action on French Meadows and Hell Hole Reservoirs combined. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Monthly median reservoir storage and water surface elevation for Hell Hole during critical and dry and below normal years are provided in Table G-20 and Table G-21, respectively. In Hell Hole Reservoir, hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of median reservoir storage from the months of June through October as compared to the Baseline Condition. Reductions in median reservoir storage during critical years would range from 3 percent in June to 13 percent in September under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during critical years would result in reduction of the median water surface elevation from the months of June through October as compared to the Baseline Condition. Reductions in median water surface elevation during critical years would range from 5 feet in June to 18 feet in September under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-20
Hell Hole Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative During Critical Years

	Storage				Elevation		
Month	Baseline Condition (TAF)	FPA (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	FPA (ft msl)	Diff (ft msl)
Oct	105	103	-2	-2	4536	4533	-3
Nov	98	98	0	0	4526	4526	0
Dec	85	85	0	0	4508	4508	0
Jan	85	85	0	0	4507	4507	0
Feb	84	84	0	0	4505	4505	0
Mar	96	96	0	0	4523	4523	0
Apr	112	112	0	0	4545	4545	0
May	129	129	0	0	4566	4566	0
Jun	121	117	-4	-3	4555	4550	-5
Jul	109	101	-8	-7	4540	4530	-11
Aug	101	89	-12	-12	4530	4514	-17
Sep	94	82	-12	-13	4520	4503	-18

Based on median monthly storage and flow over the historical record from 1974 to 2001 with a maximum 20 TAF EWA Action on French Meadows and Hell Hole Reservoirs combined. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table G-21
Hell Hole Reservoir Monthly Median Storage and Elevation Under the Baseline Condition and Flexible Purchase Alternative During Dry and Below Normal Years

	Storage				Elevation		
Month	Baseline Condition (TAF)	FPA (TAF)	Diff (TAF)	Diff (%)	Baseline Condition (ft msl)	FPA (ft msl)	Diff (ft msl)
Oct	134	122	-12	-9	4571	4556	-14
Nov	112	112	0	0	4545	4545	0
Dec	101	101	0	0	4530	4530	0
Jan	97	97	0	0	4525	4525	0
Feb	97	97	0	0	4525	4525	0
Mar	111	111	0	0	4543	4543	0
Apr	144	144	0	0	4582	4582	0
May	172	172	0	0	4615	4615	0
Jun	162	158	-4	-2	4603	4598	-4
Jul	143	135	-8	-6	4582	4572	-9
Aug	129	117	-12	-9	4565	4550	-15
Sep	114	102	-12	-11	4547	4531	-16

Based on median monthly storage and flow over the historical record from 1974 to 2001 with a maximum 20 TAF EWA Action on French Meadows and Hell Hole Reservoirs combined. Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of median reservoir storage from the months of June through October as compared to the Baseline Condition. Reductions in median reservoir storage during dry and below normal years would range from 2 percent in June to 11 percent in September under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in reduction of the median water surface elevation from the months of June through October as compared to the Baseline Condition. Reductions in median water surface elevation during dry and below normal years would range from 4 feet in June to 16 feet in September under the Flexible Purchase Alternative relative to the Baseline Condition.

Overall, median water surface elevation and median reservoir storage under the Flexible Purchase Alternative would decrease from June to January in Hell Hole Reservoir and from July to January in French Meadows Reservoir as compared to the Baseline Condition. Water temperatures during the months of greatest reduction (September and October) would be expected to be low enough, given the percentage reduction in median reservoir storage, that the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in water temperature that would affect overall reservoir water quality. Additionally, because of the high quality of the water flowing into these reservoirs, the decrease in median reservoir storage and water surface elevation would not be expected to cause an increase in concentrations of water quality constituents that would affect overall reservoir water quality. As a result, any differences in median water surface elevation and reservoir storage would not be expected to be of sufficient magnitude and frequency to affect long-term water quality in such as way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be considered less than significant.

<u>Lake McClure</u>
EWA acquisition of Merced Irrigation District (MID) water via groundwater substitution would increase surface water elevation or reservoir storage in Lake McClure, relative to the Baseline Condition.

Table G-22 provides monthly median reservoir storage and water surface elevation for Lake McClure. In Lake McClure, hydrologic conditions under the Flexible Purchase Alternative would result in an increase in median reservoir storage from the months of May through October as compared to the Baseline Condition. Increases in median reservoir storage would range from 1 percent in May and June to 4 percent in September under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative would result in an increase in the median water surface elevation from the months of May through October as compared to the Baseline Condition. Increases in median water surface elevation would range from 1 foot in June and July to 3 feet in September under the Flexible Purchase Alternative relative to the Baseline Condition. No decreases in median reservoir storage or median water surface elevation would be expected in any month.

Table G-22
Lake McClure Monthly Median Storage and Elevation
Under the Baseline Condition and Flexible Purchase Alternative

	Storage				***Elevation***		
Month	***Baseline Condition (TAF)***	***FPA (TAF)***	***Diff (TAF)***	***Diff (%)***	***Baseline Condition (ft msl)***	***FPA (ft msl)***	***Diff (ft msl)***
Oct	598	611	13	2	778	779	2
Nov	590	590	0	0	777	777	0
Dec	581	581	0	0	776	776	0
Jan	584	584	0	0	776	776	0
Feb	627	627	0	0	781	781	0
Mar	656	656	0	0	784	784	0
Apr	683	687	3	0	787	787	0
May	774	781	8	1	793	794	0
Jun	865	877	13	1	798	799	1
Jul	774	792	18	2	793	794	1
Aug	682	703	22	3	787	788	2
Sep	615	640	25	4	780	783	3

Based on median monthly storage and flow over the historical record from 1970 to 2001.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Monthly median reservoir storage and water surface elevation for Lake McClure during critical and dry and below normal years are provided in Table G-23 and Table G-24, respectively. In Lake McClure, hydrologic conditions under the Flexible Purchase Alternative during critical years would result in no reductions of median reservoir storage for all months of the year as compared to the Baseline Condition. In fact, increases would occur in the median reservoir storage during the months of April through October. Increases in the median reservoir storage would range from 0.9 percent in April to 17 percent in September. Hydrologic conditions under the Flexible Purchase Alternative during critical years would result in no reductions of the median water surface elevation for all months of the year as compared to the Baseline Condition. Increase in median water surface elevation during critical years would range from 1 foot in April to 13 feet in September under the Flexible Purchase Alternative relative to the Baseline Condition.

Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in no reductions of median reservoir storage for all months of the year as compared to the Baseline Condition. In fact increase would occur in median reservoir storage during the months of April through October. Increases in median reservoir storage during dry and below normal years would range from 0.4 percent in April to 8 percent in September under the Flexible Purchase Alternative relative to the Baseline Condition. Hydrologic conditions under the Flexible Purchase Alternative during dry and below normal years would result in no reductions of the median water surface elevation for all months of the year as compared to the Baseline Condition. Increase in median water surface elevation during dry and below normal years would range from 3 feet in July to 22 feet in October under the Flexible Purchase Alternative relative to the Baseline Condition.

Table G-23 **Lake McClure Monthly Median Storage and Elevation** **Under the Baseline Condition and Flexible Purchase Alternative During Critical Years**							
	Storage				***Elevation***		
Month	***Baseline Condition (TAF)***	***FPA (TAF)***	***Diff (TAF)***	***Diff (%)***	***Baseline Condition (ft msl)***	***FPA (ft msl)***	***Diff (ft msl)***
Oct	242	255	13	5.3	687	692	5
Nov	229	229	0	0	681	681	0
Dec	218	218	0	0	677	677	0
Jan	213	213	0	0	674	674	0
Feb	210	210	0	0	673	673	0
Mar	231	231	0	0	683	683	0
Apr	317	320	3	0.9	716	717	1
May	347	354	8	2.3	725	728	3
Jun	358	371	13	3.6	729	733	4
Jul	271	289	18	6.6	699	706	7
Aug	181	202	22	12	659	669	11
Sep	148	173	25	17	655	655	13

Based on median monthly storage and flow over the historical record from 1970 to 2001.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table G-24 **Lake McClure Monthly Median Storage and Elevation Under the** **Baseline Condition and Flexible Purchase Alternative During Dry and Below Normal Years**							
	Storage				***Elevation***		
Month	***Baseline Condition (TAF)***	***FPA (TAF)***	***Diff (TAF)***	***Diff (%)***	***Baseline Condition (ft msl)***	***FPA (ft msl)***	***Diff (ft msl)***
Oct	628	640	13	2	781	783	22
Nov	596	596	0	0	778	778	0
Dec	589	589	0	0	777	777	0
Jan	579	579	0	0	775	775	0
Feb	593	593	0	0	777	777	0
Mar	633	633	0	0	782	782	0
Apr	679	682	3	0.4	786	787	1
May	666	674	8	1.2	785	786	1
Jun	640	652	13	2	783	784	1
Jul	628	545	18	3.4	768	771	3
Aug	420	442	22	5.2	746	751	5
Sep	314	339	25	8	715	723	8

Based on median monthly storage and flow over the historical record from 1970 to 2001.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, median water surface elevation and median reservoir storage under the Flexible Purchase Alternative would be increased from May to October and would remain essentially equivalent from June through September as compared to the Baseline Condition. Increases in median reservoir storage and median water surface elevation would be expected to benefit the water quality by providing additional water for dilution of constituents and by providing additional water to buffer water temperature increases. As a result, increases in median water surface elevation and reservoir storage would not be expected to be of sufficient magnitude and frequency to affect long-term water quality in such as way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards or substantial degradation of water quality. Consequently, potential effects to water quality would be considered less than significant.

1.4.1.3 Rivers Within the Upstream from the Delta Region

Sacramento River

EWA acquisition of Sacramento River contractor water via stored reservoir water, groundwater substitution, and crop idling under the Flexible Purchase Alternative would not substantially decrease Sacramento River flow, relative to the Baseline Condition.

The long-term average flow in the Sacramento River below Keswick Dam would decrease by less than 0.8 percent under the Flexible Purchase Alternative, compared to the Baseline Condition, during all months of the year as shown in Table G-25. In fact, long-term average Sacramento River flow below Keswick Dam under the Flexible Purchase Alternative would not decrease in comparison to flows under the Baseline Condition in any month except August and September, when the long-term average decrease in flow would be 0.5 and 0.8 percent, respectively. Long-term average flows would increase by 0.9 percent in July. Further, in 828 out of 864 months simulated, Sacramento River flow below Keswick Dam under the Flexible Purchase Alternative would be essentially equivalent to or greater than flow under the Baseline Condition. The maximum flow reduction in any month would be 6.2 percent [Appendix H, p. 349-360].

Table G-25
Long-term Average Release From Keswick Dam
Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	5842	5842	0	0.0
Nov	4854	4854	0	0.0
Dec	6672	6672	0	0.0
Jan	7951	7951	0	0.0
Feb	10,056	10,056	0	0.0
Mar	8249	8249	0	0.0
Apr	7706	7706	0	0.0
May	8381	8381	0	0.0
Jun	10,529	10,529	0	0.0
Jul	13,284	13,398	114	0.9
Aug	10,556	10,498	-58	-0.5
Sep	7278	7222	-56	-0.8

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the long-term average flow in the Sacramento River below Keswick Dam during critical years would be essentially equivalent to or greater than the Baseline Condition for 113 months of the 132 months included in the analysis. Within critical years, the long-term average flow in the Sacramento River below Keswick Dam would decrease in 8 of the 11 years included in the analysis in August and in 11 of the 11 years included in the analysis in September. The long-term average flow decrease during critical years would average 170 cfs in August and 187 cfs in September, representing a 2.0 percent decrease in August and a 3.5 percent decrease in September compared to the Baseline Condition [Appendix H, p. 1006].

Under the Flexible Purchase Alternative, the long-term average flow in the Sacramento River below Keswick Dam during dry years would be essentially equivalent to or greater than the Baseline Condition for 180 months of the 192 months included in the analysis. The decreases would occur in 1 of the 16 years included in the analysis in July, in 4 of the 16 years included in the analysis in August, and in 7 of the 16 years included in the analysis in September. The long-term average flow decrease during dry years would average 17 cfs in July, 42 cfs in August, and 87 cfs in September, representing a 0.1 percent, 0.5 percent, 0.5 percent, and 1.7 percent decrease, respectively, compared to the Baseline Condition [Appendix H, p. 1006].

Under the Flexible Purchase Alternative, the long-term average flow in the Sacramento River below Keswick Dam during below normal years would be essentially equivalent to or greater than the Baseline Condition for 166 months of the 168 months included in the analysis. The decreases would occur in 1 of the 14 years included in the analysis in August and in 1 of the 14 years in September. The long-term average flow decrease during below normal years would average 445 cfs in August and 319 cfs in September, representing a 4.4 and 4.9 percent decrease for August and September, respectively, compared to the Baseline Condition [Appendix H, p. 1006].

The long-term average flow in the Sacramento River at Freeport would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table G-26. In fact, long-term average flows in the Sacramento River at Freeport would increase by more than one percent from April through September under the Flexible Purchase Alternative as compared to the Baseline Condition. Long-term average flow at Freeport under the Flexible Purchase Alternative would increase by 1.9 percent in April, 1.8 percent in May, 1.9 percent in June, 17.7 percent in July, 15.7 percent in August, and 4.7 percent in September compared to the Baseline Condition. Furthermore, in 864 of 864 months simulated, Sacramento River flow at Freeport would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 385-396]. Therefore, under the Flexible Purchase Alternative, flow in the Sacramento River at Freeport during critical, dry, and below normal years would be essentially equivalent to or greater than the Baseline Condition for all months included in the analysis.

Table G-26 Long-term Average Sacramento River Flow at Freeport Under the Baseline Condition and Flexible Purchase Alternative				
	Monthly Mean Flow[1] (cfs)		***Difference***	
Month	***Baseline Condition***	***Flexible Purchase Alternative***	***(cfs)***	***(%)[2]***
Oct	11956	12044	88	0.7
Nov	14769	14783	14	0.1
Dec	24922	24927	5	0.0
Jan	33069	33071	2	0.0
Feb	39225	39226	1	0.0
Mar	34296	34299	3	0.0
Apr	25184	25665	481	1.9
May	19724	20076	352	1.8
Jun	18183	18533	350	1.9
Jul	17777	20919	3142	17.7
Aug	13762	15929	2167	15.7
Sep	13729	14373	644	4.7

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, under the Flexible Purchase Alternative, Sacramento River flow at Keswick Dam and Freeport would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in Sacramento River flow at Freeport during summer months would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow under the Flexible Purchase Alternative would not be expected to be of sufficient frequency and magnitude to affect water quality in a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be considered less than significant.

EWA acquisition of Sacramento River contractor water via stored reservoir water, groundwater substitution, and crop idling under the Flexible Purchase Alternative would not substantially increase Sacramento River water temperature, relative to the Baseline Condition.

Under the Flexible Purchase Alternative, long-term average water temperature in the Sacramento River at Bend Bridge would not differ during any month of the year, relative to the Baseline Condition (Table G-27). Moreover, under the Flexible Purchase Alternative, water temperatures in the Sacramento River at Bend Bridge would be essentially equivalent to or less than water temperatures under the Baseline Condition in 826 out of 828 months included in the analysis. Water temperature increases in 2 of 828 months modeled at Bend Bridge would range from 0.1 to 0.5°F [Appendix H, p. 469-480].

Table G-27 ***Long-term Average Water Temperature in the Sacramento River at Bend Bridge Under the Baseline Condition and Flexible Purchase Alternative***			
	Water Temperature[1] (ºF)		
Month	***Baseline Condition***	***Flexible Purchase Alternative***	***Difference (ºF)***
Oct	53.6	53.6	0.0
Nov	51.0	51.0	0.0
Dec	47.0	47.0	0.0
Jan	44.9	44.9	0.0
Feb	48.3	48.3	0.0
Mar	52.1	52.1	0.0
Apr	54.5	54.5	0.0
May	54.6	54.6	0.0
Jun	54.6	54.6	0.0
Jul	54.6	54.6	0.0
Aug	56.8	56.8	0.0
Sep	55.8	55.8	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the long-term average water temperature in the Sacramento River at Bend Bridge during critical years would be essentially equivalent to or less than the Baseline Condition for 132 months of the 132 months included in the analysis [Appendix H, p. 1008]. Under the Flexible Purchase Alternative, the long-term average water temperature in the Sacramento River at Bend Bridge during dry years would be essentially equivalent to or less than the Baseline Condition for 192 months of the 192 months included in the analysis [Appendix H, p. 1008].

Under the Flexible Purchase Alternative, the long-term average water temperature in the Sacramento River at Bend Bridge during below normal years would be essentially equivalent to or less than the Baseline Condition for 166 months of the 168 months included in the analysis. The increases would occur in 2 of the 14 years included in the analysis in September. The long-term average water temperature increase during below normal years would average 0.3°F in September, representing up to a 0.5 percent increase compared to the Baseline Condition [Appendix H, p. 1008].

Under the Flexible Purchase Alternative, long-term average water temperature in the Sacramento River at Freeport would not differ from long-term average water temperatures under the Baseline Condition by more than 0.1°F during any month, as shown in Table G-28. Additionally, water temperature in the Sacramento River at Freeport would be essentially equivalent to or less than water temperatures under the Baseline Condition in 828 out of 828 months included in the analysis [Appendix H, p. 481-492]. Therefore, under the Flexible Purchase Alternative, water temperature in the Sacramento River at Freeport during critical, dry, and below normal years would be essentially equivalent to or less than the Baseline Condition for all months included in the analysis.

Table G-28
Long-term Average Water Temperature in the Sacramento River at Freeport Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	Baseline Condition	FPA	Difference (ºF)
Oct	60.1	60.1	0.0
Nov	52.5	52.5	0.0
Dec	46.0	45.9	-0.1
Jan	44.8	44.8	0.0
Feb	49.3	49.3	0.0
Mar	53.9	53.9	0.0
Apr	59.5	59.6	0.1
May	64.9	65.0	0.1
Jun	69.0	69.1	0.1
Jul	71.6	71.6	0.0
Aug	71.6	71.5	-0.1
Sep	68.4	68.3	-0.1

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, water temperature in the Sacramento River at Bend Bridge and Freeport under the Flexible Purchase Alternative would be essentially equivalent to or less than water temperatures relative to the Baseline Condition. Any differences in water temperature would not be expected to be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, potential water temperature-related changes to water quality would be less than significant.

<u>Lower Feather River</u>
EWA acquisition of Feather River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would not substantially decrease Feather River flow, relative to the Baseline Condition.

The long-term average flow in the Feather River below the Thermalito Afterbay would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table G-29. In fact, long-term average flows in the lower Feather River below the Thermalito Afterbay would increase by more than one percent from April through October under the Flexible Purchase Alternative as compared to the Baseline Condition. Long-term average flow below the Thermalito Afterbay under the Flexible Purchase Alternative would increase by 9.3 percent in April, 3.7 percent in May, 2.1 percent in June, 22.3 percent in July, 29.4 percent in August, 23.6 percent in September, and 2.8 percent in October (Table G-29), compared to the Baseline Condition. Furthermore, in 857 of 864 months simulated, Feather River flow below the Thermalito Afterbay would be essentially equivalent to or greater than flow under the Baseline Condition. The decrease in flow would occur in the month of July, when the long-term average flow would decrease by 3.9 percent [Appendix H, p. 892-903].

Table G-29 Long-term Average lower Feather River Flow Below Thermalito Afterbay Under the Baseline Condition and Flexible Purchase Alternative				
	Monthly Mean Flow[1] (cfs)		Difference	
Month	Baseline Condition	FPA	(cfs)	(%)[2]
Oct	2441	2509	68	2.8
Nov	2301	2315	14	0.6
Dec	3984	3989	5	0.1
Jan	5005	5007	2	0.0
Feb	5930	5931	1	0.0
Mar	6144	6146	2	0.0
Apr	3416	3734	318	9.3
May	3826	3969	143	3.7
Jun	5084	5192	108	2.1
Jul	5896	7210	1314	22.3
Aug	4434	5737	1303	29.4
Sep	1600	1977	377	23.6

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the long-term average flows in the Feather River below Thermalito Afterbay during critical years would be essentially equivalent to or greater than the Baseline Condition for 101 months of the 132 months included in the analysis. Within critical years, the long-term average flow in the Feather River below Thermalito Afterbay would decrease in 11 of the 11 years included in the analysis each in May and June, in 4 of the 11 years included in the analysis in February, and 1 of the 11 years included in the analysis in March and October through January. The long-term average flow decrease during critical years would average 1 cfs or less for all months, representing a 0.1 percent or less decrease, compared to the Baseline Condition [Appendix H, p. 1019].

Under the Flexible Purchase Alternative, the long-term average flow in the Feather River below Thermalito Afterbay during dry years would be essentially equivalent to or greater than the Baseline Condition for 128 months of the 192 months included in the analysis. Within dry years, the long-term average flow in the Feather River below Thermalito Afterbay would decrease in 16 of the 16 years included in the analysis in May and June, in 6 of the 16 years included in the analysis in February and April, in 4 of the 16 years included in the analysis in July, in 3 of the 16 years included in the analysis in January, March, and October through December, and in 1 of the 16 years included in the analysis in September. The long-term average flow decrease during dry years would average 163 cfs in July and 3 cfs or less for all other months, representing a 2 percent decrease in July and 0.2 percent or smaller decrease for all other months, compared to the Baseline Condition [Appendix H, p. 1019].

Under the Flexible Purchase Alternative, the long-term average flow in the Feather River below Thermalito Afterbay during below normal years would be essentially equivalent to or greater than the Baseline Condition for 94 of the 168 months included in the analysis. Within below normal years, the long-term average flow in the Feather River below Thermalito Afterbay would decrease in 14 of the 14 years included in the analysis in June, in 13 of the 14 years included in the analysis in May, in 7 of the 14 years included in the analysis in April, in 6 of the 14 years included in the analysis in February and September, in 5 of the 14 years included in the analysis in March and October through January, and in 3 of the 14 years included in the analysis in July. The long-term average flow decrease for below normal years would average 252 cfs in July and 4 cfs or less for all other months, representing a 3 percent decrease in July and 0.1 percent or less for all other months, compared to the Baseline Condition [Appendix H, p. 1019].

The long-term average flow at the mouth of the Feather River would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year, as shown in Table G-30. In fact, flows in the Feather River at the mouth would increase by more than one percent from April through October under the Flexible Purchase Alternative, compared to the Baseline Condition. Long-term average flow at the mouth of the Feather River under the Flexible Purchase Alternative would increase by 3.3 percent in April, 1.8 percent in May, 1.4 percent in June, 34.6 percent in July, 33.4 percent in August, 13.2 percent in September, and 2.1 percent in October, compared to the Baseline Condition. Furthermore, in 864 of 864 months simulated, Feather River flow at the mouth would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 868-879]. Therefore, under the Flexible Purchase Alternative, flow at the mouth of the Feather River during critical, dry, and below normal years would be essentially equivalent to or greater than the Baseline Condition for all months included in the analysis.

Table G-30
Long-term Average Feather River Flow at the Mouth
Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	FPA	(cfs)	(%)[2]
Oct	3284	3352	68	2.1
Nov	3482	3496	14	0.4
Dec	6227	6232	5	0.1
Jan	11355	11357	2	0.0
Feb	13096	13097	1	0.0
Mar	13182	13184	2	0.0
Apr	9518	9836	318	3.3
May	7735	7877	142	1.8
Jun	7647	7755	108	1.4
Jul	6311	8497	2186	34.6
Aug	4881	6512	1631	33.4
Sep	3404	3852	448	13.2

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, under the Flexible Purchase Alternative, Feather River flow below the Thermalito Afterbay and at the mouth would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in Feather River flow below Thermalito Afterbay and at the mouth during summer months would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow would not be expected to be of sufficient frequency and magnitude to affect water quality in a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

EWA acquisition of Feather River contractor water via stored reservoir water, groundwater substitution, and crop idling under the Flexible Purchase Alternative would not substantially increase Feather River water temperature, relative to the Baseline Condition. Under the Flexible Purchase Alternative, long-term average water temperature in the Feather River at the Fish Barrier Dam would not differ during any month of the year, relative to the Baseline Condition (Table G-31). Moreover, under the Flexible Purchase Alternative, water temperatures in the Feather River at the Fish Barrier Dam would be essentially equivalent to water temperatures under the Baseline Condition in 828 out of 828 months included in the analysis [Appendix H, p. 940-951].

Table G-31
Long-term Average Water Temperature in the Feather River Below the Fish Barrier Dam Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	Baseline Condition	FPA	Difference (ºF)
Oct	54.0	54.0	0.0
Nov	52.4	52.4	0.0
Dec	48.0	48.0	0.0
Jan	46.0	46.0	0.0
Feb	47.1	47.1	0.0
Mar	49.0	49.0	0.0
Apr	51.0	51.0	0.0
May	55.3	55.3	0.0
Jun	57.4	57.4	0.0
Jul	61.6	61.6	0.0
Aug	60.8	60.8	0.0
Sep	56.5	56.5	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, long-term average water temperature in the Feather River below Thermalito Afterbay would not differ from long-term average temperatures under the Baseline Condition during any month of the year, as shown in Table G-32. Additionally, water temperature in the Feather River below the Thermalito Afterbay would be essentially equivalent to water temperatures under the Baseline Condition in 827 out of 828 months included in the analysis. The greatest decrease in temperature would be 0.1°F, occurring in July during a wet year

[Appendix H, p. 916-927]. Therefore, under the Flexible Purchase Alternative, water temperature below the Thermalito Afterbay in the Feather River during critical, dry, and below normal years would be essentially equivalent to or less than the Baseline Condition for all months included in the analysis.

Table G-32
Long-term Average Water Temperature in the Feather River Below Thermalito Afterbay Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	No Action/No Project Alternative	FPA	Difference (ºF)
Oct	59.6	59.6	0.0
Nov	53.0	53.0	0.0
Dec	46.4	46.4	0.0
Jan	45.3	45.3	0.0
Feb	49.0	49.0	0.0
Mar	52.7	52.7	0.0
Apr	57.0	57.0	0.0
May	62.4	62.4	0.0
Jun	66.2	66.2	0.0
Jul	70.1	70.1	0.0
Aug	69.2	69.2	0.0
Sep	64.7	64.7	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, long-term average water temperature at the mouth of the Feather River would not increase from the long-term average water temperature under the Baseline Condition by more than 0.2°F during any month, as shown in Table G-33. Additionally, water temperature at the mouth of the Feather River would be essentially equivalent to or less than water temperatures under the Baseline Condition in 796 out of 828 months included in the analysis. Water temperature increases in 32 of 828 months modeled would range from 0.4 to 0.7°F [Appendix H, p. 928-939].

Table G-33
Long-term Average Water Temperature at the Mouth of the Feather River Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	Baseline Condition	FPA	Difference (ºF)
Oct	61.3	61.3	0.0
Nov	52.4	52.4	0.0
Dec	45.9	45.9	0.0
Jan	45.3	45.3	0.0
Feb	49.6	49.6	0.0
Mar	54.2	54.2	0.0
Apr	59.8	59.9	0.1
May	65.5	65.6	0.1
Jun	70.0	70.2	0.2
Jul	73.6	73.6	0.0
Aug	72.2	71.8	-0.4
Sep	69.7	69.2	-0.5

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the long-term average water temperature at the mouth of the Feather River during critical years would be essentially equivalent to or less than the Baseline Condition for 113 months of the 132 months included in the analysis. Within critical years, the long-term average water temperature in the Feather River at the mouth would not decrease in all months of the year except during July through September and May, and increases in the long-term average water temperature would occur in all months of the year except during November through March and August. The increases would occur in 1 of the 11 years included in the analysis in October and September, in 9 of the 11 years included in the analysis in April, in 8 of the 11 years included in the analysis in May, in 6 of the 11 years included in the analysis in June, and in 4 of the 11 years included in the analysis in July. The greatest long-term average water temperature increase during critical years would occur in May. During May, the long-term average water temperature would increase by 0.35ºF, representing up to a 0.5 percent increase compared to the Baseline Condition [Appendix H, p. 1018].

Under the Flexible Purchase Alternative, the long-term average water temperature in the Feather River at the mouth during dry years would be essentially equivalent to or less than the Baseline Condition for 164 months of the 192 months included in the analysis. Within dry years, the long-term average water temperature at the mouth of the Feather River would not decrease in any months of the year except July through September. Increases would occur in all months of the year except during November through March and September. The increases would occur in 4 of the 16 years included in the analysis in October, and would range from 3 to 10 of the 16 years included in the analysis during April through August. The greatest long-term average water temperature increase during dry years would occur during May. During May, the long-term average water temperature would increase by 0.33ºF, representing up to a 0.5 percent increase compared to the Baseline Condition [Appendix H, p. 1018].

Under the Flexible Purchase Alternative, the long-term average water temperature at the mouth of the Feather River during below normal years would be essentially equivalent to or less than the Baseline Condition for 141 months of the 168 months included in the analysis. During below normal years, the long-term average water temperature at the mouth of the Feather River would not decrease in any month of the year except during July through September, and increases would occur in all months of the year except during October through March and September. The increases would range from 2 to 7 years of the 14 years included in the analysis in April through August. The greatest long-term average water temperature increase during below normal years would occur during June. During June, the long-term average water temperature would increase by 0.24ºF, representing up to a 0.3 percent increase compared to the Baseline Condition [Appendix H, p. 1018].

Overall, water temperature in the Feather River below the Thermalito Afterbay, and at the mouth under the Flexible Purchase Alternative would infrequently be increased by up to 0.7°F and would otherwise be essentially equivalent to or less than water temperatures relative to the Baseline Condition. Any differences in water temperature would not be expected to be of sufficient frequency and magnitude to affect water quality in a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, potential water temperature-related changes to water quality would be less than significant.

Lower Yuba River

EWA acquisition of lower Yuba River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter lower Yuba River flow, relative to the Baseline Condition.

The Yuba River is one of many Central Valley rivers that have been utilized in water transfer projects for a number of years. In 2001, Yuba County Water Agency (YCWA) and other local water agencies initiated water transfers from New Bullards Bar Reservoir through the Yuba River in order to satisfy a variety of downstream needs. The total water transfer consisted of approximately 172,000 acre-feet of water, including 114,052 acre-feet utilized by DWR. The water transfers occurred approximately between July 1, 2001 and October 14, 2001. The water transfers increased flows by about 1,200 cfs in the lower Yuba River through late August. Yuba River water transfers also occurred during 2002. Yuba County Water Agency transferred a total of 162,050 acre-feet of water for downstream needs (157,050 acre-feet allocated to DWR, and 5,000 acre-feet to the Contra Costa Water District) from approximately mid-June through September, 2002.

Recent historic flows in the Yuba River below Englebright Dam during June through October, the typical time period for water transfers, have been between approximately 600 and 2,500 cfs. Preliminary hydrologic modeling output for flows under the Baseline Condition (without EWA transfer) below Englebright Reservoir would range between approximately 1,000 and 1,800 cfs during June, July, and most of August, ramp down in late August and early September to 500 cfs to 900 cfs, and remain relatively constant at 600 to 900 cfs for October and November until the wet season, at which time unregulated winter storm and snowmelt flows affect the lower Yuba River hydrology. Below Daguerre Point Dam, baseline flows could range from approximately 245 to 800 cfs in June, and from 100 to 250 cfs during July, August, and September. Flows below Daguerre Point Dam in the first two weeks in October could be about 320 to 400 cfs and increase to 400 to 500 cfs for the last two weeks of October through the time period in the winter when runoff from winter storms significantly affect river flows.

Under the maximum transfer scenario of the Flexible Purchase Alternative, the proposed transfer of 185,000 acre-feet to the EWA is expected to take place mainly in July and August, with some water potentially released between June 1 and July 31, and between September 1 and October 31. During late June, July, and August, flow rates would be relatively constant, at up to 1,200 to 1,500 cfs above Yuba River instream flow and diversion delivery requirements. Under the variable transfer scenario of the Flexible Purchase Alternative, the expected amount of water to be transferred to the EWA is 30,000 acre-feet. As with the maximum transfer, the delivery of this water would take place mainly in July and August, with some water released between September 1 and October 31. Releases of transfer water would start in June or early July and would depend on Delta conditions and the SWP's ability to pump the water. During late June, July, and August, flow rates would be relatively constant, at up to 500 cfs above Yuba River instream flow and diversion delivery requirements. This maximum flow rate would occur if all of the transfer water were to be delivered in one month. Transfers under either scenario could affect water levels in Lake Oroville only if DWR released stored water to compensate for reduced flows to the Delta during the period when New Bullards Bar Reservoir was being refilled by the additional amount of evacuated storage resulting from the transfer. The need for increased releases from Lake Oroville resulting from reduced releases from New Bullards Bar Reservoir and thus reduced Yuba River outflow would occur only under certain hydrologic conditions.

Overall, under the Flexible Purchase Alternative, lower Yuba River flow would be greater than the flows under the Baseline Condition, based on data from previous water transfers. Increases in lower Yuba River flow would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, increases in flow would not be expected to be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

EWA acquisition of lower Yuba River contractor water via stored reservoir water, groundwater substitution and crop idling under the Flexible Purchase Alternative would alter lower Yuba River water temperature, relative to the Baseline Condition.

Monitoring of lower Yuba River water temperatures during past water transfers showed that water temperatures at the mouth of the Yuba River (Highway 70 Bridge) were approximately 73°F prior to the 2001 water transfers. At the same time, similar water temperatures were observed on the Feather River, one kilometer above its confluence with the Yuba River. After the initiation of the 2001 water transfers, water temperatures at the mouth of the Yuba River dropped to an average of 61°F for the remainder of the month (CDFG, unpublished data). Water temperatures at this site remained around 61°F until flows were reduced in late August, at which time the water temperatures increased coincident with flow reduction. Although an evaluation of the numerous variables (e.g., ambient air temperature, cloud cover, diversion rates) which may influence instream water temperatures has not yet been conducted, changes in Yuba River water temperatures were observed coincident with the water transfers.

Overall, under the Flexible Purchase Alternative, lower Yuba River water temperatures would be less than the water temperatures under the Baseline Condition, based on data from previous water transfers. Decreases in Yuba River water temperature with implementation of the Flexible Purchase Alternative would not be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, potential water temperature-related changes to water quality would be less than significant.

<u>Middle Fork American River</u>
EWA acquisition of American River contractor water via stored reservoir water and crop idling under the Flexible Purchase Alternative would alter Middle Fork American River flow, relative to the Baseline Condition.

The median flow in the Middle Fork American River below Ralston Afterbay would not decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during nine months of the year as shown in Table G-16. In fact, the median flow in the Middle Fork American River below Ralston Afterbay under the Flexible Purchase Alternative would increase in comparison to flows under the Baseline Condition in June through September. Flows would increase 10.7 percent in June, 17.1 percent in July, 16.1 percent in August, and 9.6 percent in September. However, median flow in the Middle Fork American River would decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during November, January and February. Median flow in the Middle Fork American River would decrease by 43.6 percent in November, 5.3 percent in January, and 25.6 percent in February.

The median flow in the Middle Fork American River below Ralston Afterbay during critical, dry, and below normal years under the Flexible Purchase Alternative, compared to the Baseline Condition are shown in Table G-17 and Table G-18. The median flow in the Middle Fork American River below Ralston Afterbay under the Flexible Purchase Alternative during critical years would increase in comparison to flows under the Baseline Condition in June through September. Flows during critical years would increase 20.5 percent in June, 23.5 percent in July, 27.5 percent in August, and 13.3 percent in September. However, median flow in the Middle Fork American River during critical years would decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during October and November. Median flow in the Middle Fork American River during critical years would decrease by 81.9 percent in October and 19.2 percent in November.

The median flow in the Middle Fork American River below Ralston Afterbay under the Flexible Purchase Alternative during dry and below normal years would increase in comparison to flows under the Baseline Condition in June through September. Flows during dry and below normal years would increase 16.5 percent in June, 21.3 percent in July, 18.1 percent in August, and 10.0 percent in September. However, median flow in the Middle Fork American River during dry and below normal years would decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during November. Median flow in the Middle Fork American River during dry and below normal years would decrease by 60 percent in November.

Overall, under the Flexible Purchase Alternative, Middle Fork American River median flow below Ralston Afterbay would be essentially equivalent to greater than flows under the Baseline Condition in nine months out of the year. Median flow in the Middle Fork American River would decrease in November, January, and February under the Flexible Purchase Alternative as compared to the Baseline Condition. Increases in Middle Fork American River flow below Ralston Afterbay in June, July, August, and September would allow dilution of water quality constituents. Decreased flows during the months of greatest flow reduction (November and February) would not be expected to cause an increase in water quality constituents that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality because the water quality in the Middle Fork American River is of high quality and concentrations of constituents are generally low. Consequently, potential flow-related effects to water quality would be considered less than significant.

<u>Lower American River</u>
EWA acquisition of stored groundwater from Sacramento Groundwater Authority members, stored reservoir water, and water obtained through Placer Country Water Agency crop idling and retained in Folsom Reservoir under the Flexible Purchase Alternative would increase lower American River flow, relative to the Baseline Condition.

The long-term average flow in the lower American River below Nimbus Dam would not decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during all months of the year as shown in Table G-34. In fact, long-term average lower American River flow below Nimbus Dam under the Flexible Purchase Alternative would increase by 2.6 percent in July, 1.9 percent in August, and 2.6 percent in September, compared to the Baseline Condition. Further, in 864 out of 864 months simulated, lower American River flow below Nimbus Dam under the Flexible Purchase Alternative would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 313-324]. Therefore, under the Flexible Purchase Alternative, flow in the lower American River below Nimbus Dam during critical, dry, and below normal years would be essentially equivalent to or greater than the Baseline Condition for all months included in the analysis [Appendix H, p. 1015].

Table G-34 Long-term Average Release to the Lower American River From Nimbus Dam Under the Baseline Condition and Flexible Purchase Alternative				
	Monthly Mean Flow[1] (cfs)		Difference	
Month	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	1678	1678	0	0.0
Nov	2502	2502	0	0.0
Dec	3498	3498	0	0.0
Jan	4124	4124	0	0.0
Feb	4989	4989	0	0.0
Mar	3941	3941	0	0.0
Apr	3616	3616	0	0.0
May	3793	3793	0	0.0
Jun	4166	4166	0	0.0
Jul	4100	4208	108	2.6
Aug	2482	2528	46	1.9
Sep	2876	2885	9	2.6

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

The long-term average lower American River flow at Watt Avenue would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table G-35. In fact, long-term average flow at Watt Avenue under the Flexible Purchase Alternative would increase by 2.9 percent in July and 2.1 percent in August, compared to the Baseline Condition. Furthermore, in 864 of 864 months simulated, lower American River flow at Watt Avenue would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 325-336]. Therefore, under the Flexible Purchase Alternative, flow at Watt Avenue in the lower American River during critical, dry, and below normal years would be essentially equivalent to or greater than the Baseline Condition for all months included in the analysis.

The long-term average flow at the mouth of the American River would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table G-36. In fact, long-term average flow at the mouth of the American River under the Flexible Purchase Alternative would increase by 2.8 percent in July and 2.0 percent in August, compared to the Baseline Condition. Furthermore, in 864 of 864 months simulated, American River flow at the mouth would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 361-372]. Therefore, under the Flexible Purchase Alternative, flow at the mouth of the American River during critical, dry, and below normal years would be essentially equivalent to or greater than the Baseline Condition for all months included in the analysis.

Table G-35 Long-term Average Flow at Watt Avenue Under the Baseline Condition and Flexible Purchase Alternative				
Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	1507	1507	0	0.0
Nov	2385	2385	0	0.0
Dec	3402	3402	0	0.0
Jan	4038	4038	0	0.0
Feb	4906	4906	0	0.0
Mar	3861	3861	0	0.0
Apr	3428	3428	0	0.0
May	3531	3531	0	0.0
Jun	3814	3814	0	0.0
Jul	3729	3837	108	2.9
Aug	2148	2194	46	2.1
Sep	2633	2642	9	0.3

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Table G-36 Long-term Average Flow at the Mouth of the lower American River Under the Baseline Condition and Flexible Purchase Alternative				
Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	1557	1557	0	0.0
Nov	2426	2426	0	0.0
Dec	3441	3441	0	0.0
Jan	4077	4077	0	0.0
Feb	4949	4949	0	0.0
Mar	3902	3902	0	0.0
Apr	3518	3518	0	0.0
May	3632	3632	0	0.0
Jun	3936	3936	0	0.0
Jul	3851	3958	107	2.8
Aug	2253	2299	46	2.0
Sep	2707	2716	9	0.3

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1, Assessment Methods.

Overall, under the Flexible Purchase Alternative, lower American River flow below Nimbus Dam, at Watt Avenue, and at the mouth would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in lower American River flow at all three locations during July and August and during September at Nimbus Dam would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow would not be expected to be of sufficient frequency and magnitude to affect water quality in a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be considered less than significant.

EWA acquisition of stored groundwater from Sacramento Groundwater Authority members, stored reservoir water, and water obtained through Placer Country Water Agency crop idling and retained in Folsom Reservoir under the Flexible Purchase Alternative would not substantially increase American River water temperature, relative to the Baseline Condition. Under the Flexible Purchase Alternative, long-term average water temperature in the American River below Nimbus Dam would not differ by more than 0.2ºF during any month of the year, relative to the Baseline Condition (Table G-37). Moreover, under the Flexible Purchase Alternative, water temperatures in the American River below Nimbus Dam would be essentially equivalent to or less than water temperatures under the Baseline Condition in 805 out of 828 months included in the analysis. Water temperature increases in 23 of 828 months modeled below Nimbus Dam would range from 0.4 to 1.0°F [Appendix H, p. 409-420].

Table G-37
Long-term Average Water Temperature in the American River Below Nimbus Dam Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	Baseline Condition	Flexible Purchase Alternative	Difference (ºF)
Oct	56.3	56.3	0.0
Nov	56.5	56.5	0.0
Dec	51.2	51.2	0.0
Jan	47.2	47.1	-0.1
Feb	47.8	47.8	0.0
Mar	50.3	50.4	0.1
Apr	53.7	53.8	0.1
May	56.5	56.6	0.1
Jun	59.6	59.6	0.0
Jul	64.3	64.3	0.0
Aug	64.5	64.6	0.1
Sep	65.9	66.1	0.2

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1, Assessment Methods.

Under the Flexible Purchase Alternative, the long-term average water temperature in the American River below Nimbus Dam during critical years would be essentially equivalent to or less than the Baseline Condition for 121 months of the 132 months included in the analysis. Within critical years, the long-term average water temperature in the American River below Nimbus Dam would not decreases in any months of the year except during November through January, April and September, and increases in the long-term average water temperature would occur all months of the year except during December and January. The increases would occur in 6 of the 11 years included in the analysis in October, in 3 of the 11 years included in the analysis in February, in 7 of the 11 years included in the analysis in November, March, June, and September, in 5 of the 11 years included in the analysis in April and August, in 4 of the 11 years included in the analysis in May, and in 1 of the 11 years included in the analysis in July. The greatest long-term average water temperature increase during critical years would occur during September. During September, the long-term average water temperature would increase by 0.36ºF, representing up to a 0.5 percent increase compared to the Baseline Condition [Appendix H, p. 1016].

Under the Flexible Purchase Alternative, the long-term average water temperature in the American River below Nimbus Dam during dry years would be essentially equivalent to or less than the Baseline Condition for 161 months of the 192 months included in the analysis. Within dry years, the long-term average water temperature in the American River below Nimbus Dam would decrease during all months of the year except during March through April and July through September. Increases would occur during all months of the year except during December and January. The increases would occur in 5 of the 16 years included in the analysis in October, in 3 of the 16 years included in the analysis in November, and would range from 2 to 13 of the 16 years included in the analysis in February through September. The greatest long-term average water temperature increase during dry years would occur during September. During September, the long-term average water temperature would increase by 0.27ºF, representing up to a 0.5 percent increase compared to the Baseline Condition [Appendix H, p. 1016].

Under the Flexible Purchase Alternative, the long-term average water temperature in the American River below Nimbus Dam during below normal years would be essentially equivalent to or less than the Baseline Condition for 144 months of the 168 months included in the analysis. During below normal years, the long-term average water temperature in the American River below Nimbus Dam would decrease in all months of the year except during March through April, and increases would occur all months of the year except during December through January. The increases would range from 5 to 6 years of the 14 years included in the analysis in October through November and would range from 2 to 13 of the 14 years included in the analysis in February through September. The greatest long-term average temperature increase during below normal years would occur during October. During October, the long-term average water temperature would increase by 0.25ºF, representing up to a 0.4 percent increase compared to the Baseline Condition [Appendix H, p. 1016].

Under the Flexible Purchase Alternative, long-term average water temperature in the American River at Watt Avenue would not differ from long-term average water temperatures under the Baseline Condition by more than 0.1°F during any month, as shown in Table G-38. Additionally, water temperature in the American River at Watt Avenue would be essentially equivalent to or less than water temperatures under the Baseline Condition in 815 out of 828 months included in the analysis. Water temperature increases in 13 of 828 months modeled would range from 0.4 to 0.7°F [Appendix H, p. 421-432].

Under the Flexible Purchase Alternative, the long-term average water temperature in the American River at Watt Avenue during critical years would be essentially equivalent to or less than the Baseline Condition for 124 months of the 132 months included in the analysis. Within critical years, the long-term average water temperature in the American River at Watt Avenue would not decrease in any months of the year except during November through January, and increases in the long-term average water temperature would occur all months of the year except during December through January. The increases would occur in 4 of the 11 years included in the analysis in October, April, and September, in 2 of the 11 years included in the analysis in February, in 5 of the 11 years included in the analysis in March, in 6 of the 11 years included in the analysis in November and June, in 3 of the 11 years included in the analysis in May and August, and in 1 of the 11 years included in the analysis in July. The greatest long-term average water temperature increase during critical years would occur during September. During September, the long-term average water temperature would increase by 0.33ºF, representing up to a 0.5 percent increase compared to the Baseline Condition [Appendix H, p. 1014].

Table G-38
Long-term Average Water Temperature in the American River at Watt Avenue Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	Baseline Condition	Flexible Purchase Alternative	Difference (ºF)
Oct	57.7	57.7	0.0
Nov	55.8	55.8	0.0
Dec	50.2	50.2	0.0
Jan	46.7	46.7	0.0
Feb	48.2	48.2	0.0
Mar	51.2	51.3	0.1
Apr	55.1	55.2	0.1
May	58.7	58.7	0.0
Jun	62.0	62.0	0.0
Jul	66.2	66.2	0.0
Aug	66.9	66.9	0.0
Sep	66.8	66.8	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the long-term average water temperature in the American River at Watt Avenue during dry years would be essentially equivalent to or less than the Baseline Condition for 167 months of the 192 months included in the analysis. Within dry years, the long-term average water temperature in the American River at Watt Avenue would not decrease in any months of the year except during October through February. Increases would occur all months of the year except during December through January. The increases would occur in 5 of the 16 years included in the analysis in October, in 3 of the 16 years included in the analysis in November, and would range from 2 to 12 of the 16 years included in the analysis during February through September. The greatest long-term average water temperature increase during dry years would occur during July, August, and September. During these months the long-term average water temperature would increase by 0.20ºF, representing up to a 0.3 percent increase compared to the Baseline Condition [Appendix H, p. 1014].

Under the Flexible Purchase Alternative, the long-term average water temperature in the American River at Watt Avenue during below normal years would be essentially equivalent to or less than the Baseline Condition for 147 months of the 168 months included in the analysis. During below normal years, the long-term average water temperature in the American River at Watt Avenue would decrease in all months of the year except during March through May, and increases would occur in all months of the year except during December and January. The increases would occur in 5 of the 14 years included in the analysis in October, 3 of the 14 years included in the analysis in November, and would range from 2 to 8 of the 14 years included in the analysis during February through September. The greatest long-term average water temperature increase during below normal years would occur during November. During November, the long-term average water temperature would increase by 0.23ºF, representing up to a 0.4 percent increase compared to the Baseline Condition [Appendix H, p. 1014].

Under the Flexible Purchase Alternative, long-term average water temperature at the mouth of the American River would not differ from long-term average temperatures under the Baseline Condition by more than 0.1°F during any month, as shown in Table G-39. Additionally, water temperature in the American River at the mouth would be essentially equivalent to or less than water temperatures under the Baseline Condition in 821 out of 828 months included in the analysis. Water temperature increases in 9 of 828 months modeled would range from 0.4 to 0.6°F [Appendix H, p. 433-444].

Table G-39
Long-term Average Water Temperature at the Mouth of the American River Under the Baseline Condition and Flexible Purchase Alternative

Month	Water Temperature[1] (ºF)		
	Baseline Condition	Flexible Purchase Alternative	Difference (ºF)
Oct	58.4	58.4	0.0
Nov	55.5	55.5	0.0
Dec	49.7	49.6	-0.1
Jan	46.5	46.5	0.0
Feb	48.5	48.5	0.0
Mar	51.7	51.8	0.1
Apr	55.8	55.9	0.1
May	59.7	59.8	0.1
Jun	63.2	63.3	0.1
Jul	67.2	67.2	0.0
Aug	68.1	68.1	0.0
Sep	67.3	67.3	0.0

[1] Based on 69 years modeled.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Under the Flexible Purchase Alternative, the long-term average water temperature at the mouth of the American River during critical years would be essentially equivalent to or less than the Baseline Condition for 115 months of the 132 months included in the analysis. Within critical years, the long-term average water temperature in the

American River at the mouth would decrease in all months of the year except during March through June and October. Increases in the long-term average water temperature would occur all months of the year except during December and January. The increases would range from 3 to 4 of the 11 years included in the analysis in October through November and would range from 2 to 7 of the 11 years included in the analysis in February through September. The greatest long-term average water temperature increase during critical years would occur during September. During September, the long-term average water temperature would increase by 0.45ºF, representing up to a 0.7 percent increase compared to the Baseline Condition [Appendix H, p. 1012].

Under the Flexible Purchase Alternative, the long-term average water temperature at the mouth of the American River during dry years would be essentially equivalent to or less than the Baseline Condition for 159 months of the 192 months included in the analysis. Within dry years, the long-term average water temperature in the American River at the mouth would decrease in all months of the year except during March and April. Increases would occur in all months of the year except during December and January. The increases would occur in 4 of the 16 years included in the analysis in October, August, and September, in 3 of the 16 years included in the analysis in November and July, and would range from 1 to 13 of the 16 years included in the analysis during February through June. The greatest long-term average water temperature increase during dry years would occur during July. During July, the long-term average water temperature would increase by 0.20ºF, representing up to a 0.3 percent increase compared to the Baseline Condition [Appendix H, p. 1012].

Under the Flexible Purchase Alternative, the long-term average water temperature at the mouth of the American River during below normal years would be essentially equivalent to or less than the Baseline Condition for 147 months of the 168 months included in the analysis. During below normal years, the long-term average water temperature at the mouth of the American River would decrease in all months of the year except during March through June, and increases would occur in all months of the year except during December, January, and July. The increases would occur in 5 of the 14 years included in the analysis in October and June, in 2 of the 14 years included in the analysis in November and September, in 1 of the 14 years included in the analysis in August, and would range from 3 to 10 of the 14 years included in the analysis in February through May. The greatest long-term average water temperature increase during below normal years would occur during November. During November, the long-term average water temperature would increase by 0.25ºF, representing up to a 0.5 percent increase compared to the Baseline Condition [Appendix H, p. 1012].

Overall, water temperature in the American River below Nimbus Dam, at Watt Avenue and at the mouth under the Flexible Purchase Alternative would infrequently be increased by up to 1.0°F and would otherwise be essentially equivalent to or less than water temperatures relative to the Baseline Condition. Any differences in water temperature would not be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Consequently, potential water temperature-related changes to water quality would be less than significant.

Merced River

EWA acquisition of Merced River contractor water via groundwater substitution under the Flexible Purchase Alternative would increase Merced River flow, relative to the Baseline Condition.

The long-term average flow in the Merced River below Crocker-Huffman Dam would not decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during any month of the year as shown in Table G-40. In fact, long-term average Merced River flow below Crocker Huffman Dam under the Flexible Purchase Alternative would increase in comparison to the Baseline Condition in October and November, when the long-term average flow would increase 25.0 percent and 90.9 percent, respectively. Further, in 864 out of 864 months simulated, Merced River flow below Crocker-Huffman Dam under the Flexible Purchase Alternative would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 964-975].

Table G-40
Long-term Average Flow Below Crocker-Huffman Dam
Under the Baseline Condition and Flexible Purchase Alternative

	Monthly Mean Flow[1] (cfs)		***Difference***	
Month	***Baseline Condition***	***Flexible Purchase Alternative***	***(cfs)***	***(%)[2]***
Oct	812	1015	203	25.0
Nov	231	441	210	90.9
Dec	353	353	0	0.0
Jan	493	493	0	0.0
Feb	784	784	0	0.0
Mar	500	500	0	0.0
Apr	501	501	0	0.0
May	894	894	0	0.0
Jun	881	881	0	0.0
Jul	329	329	0	0.0
Aug	159	159	0	0.0
Sep	178	178	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

The long-term average flow at the mouth of the Merced River would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table G-41. In fact, flows in the Merced River at the mouth would increase in October and November under the Flexible Purchase Alternative as compared to the Baseline Condition. Long-term average flow at the mouth of the Merced River under the Flexible Purchase Alternative would increase by 23.2 percent in October and 73.3 percent in November compared to the Baseline Condition. Furthermore, in 864 of 864 months simulated, Merced River flow at the mouth would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 976-987].

Table G-41
Long-term Average Flow at the Mouth of the Merced River Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	881	1085	204	23.2
Nov	288	499	211	73.3
Dec	438	438	0	0.0
Jan	596	596	0	0.0
Feb	936	936	0	0.0
Mar	654	654	0	0.0
Apr	517	517	0	0.0
May	865	865	0	0.0
Jun	827	827	0	0.0
Jul	333	333	0	0.0
Aug	189	189	0	0.0
Sep	193	193	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

Overall, under the Flexible Purchase Alternative, Merced River flow below Crocker-Huffman Dam and at the mouth would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in Merced River flow at Crocker-Huffman Dam and at the mouth during October and November would allow dilution of water quality constituents. As a result, any differences in flow would not be expected to be of sufficient frequency and magnitude to affect water quality in such a way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

<u>San Joaquin River</u>
EWA acquisition of Merced River contractor water via groundwater substitution under the Flexible Purchase Alternative would increase San Joaquin River flow, relative to the Baseline Condition.

The long-term average flow in the San Joaquin River below the confluence with the Merced River would not decrease under the Flexible Purchase Alternative, compared to the Baseline Condition, during any month of the year as shown in Table G-42. In fact, long-term average San Joaquin River flow below the confluence with the Merced River under the Flexible Purchase Alternative would increase in comparison to flows under the Baseline Condition in October and November, when the long-term average flow would increase by 14.6 percent and 28.8 percent, respectively. Further, in 864 out of 864 months simulated, San Joaquin River flow below the confluence with the Merced River under the Flexible Purchase Alternative would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 988-999].

Table G-42
Long-term Average San Joaquin River Flow Below the Merced River Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	1391	1594	203	14.6
Nov	729	939	210	28.8
Dec	1138	1138	0	0.0
Jan	1648	1648	0	0.0
Feb	2381	2381	0	0.0
Mar	2066	2066	0	0.0
Apr	1739	1739	0	0.0
May	2236	2236	0	0.0
Jun	1997	1997	0	0.0
Jul	830	830	0	0.0
Aug	575	575	0	0.0
Sep	774	774	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

The long-term average flow at Vernalis in the San Joaquin River (for this analysis, also referred to as the long-term average Delta inflow from the San Joaquin River) would not decrease under the Flexible Purchase Alternative as compared to the Baseline Condition, during any month of the year as shown in Table G-43. In fact, long-term average flows in the San Joaquin River at Vernalis under the Flexible Purchase Alternative would increase by 6.7 percent in October and 10.6 percent in November compared to the Baseline Condition. Furthermore, in 864 of 864 months simulated, San Joaquin River flow at Vernalis would be essentially equivalent to or greater than flow under the Baseline Condition [Appendix H, p. 73-84].

Overall, under the Flexible Purchase Alternative, San Joaquin River flow below the confluence with the Merced River and at Vernalis would be essentially equivalent to or greater than the flows under the Baseline Condition. Increases in San Joaquin River flow at both locations during October and November would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow would not be expected to be of sufficient frequency and magnitude to affect water quality in such as way that would result in long-term adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality. Therefore, potential flow-related changes to water quality under the Flexible Purchase Alternative would be less than significant.

Table G-43
Long-term Average Delta Inflow from the San Joaquin River
Under the Baseline Condition and Flexible Purchase Alternative

Month	Monthly Mean Flow[1] (cfs)		Difference	
	Baseline Condition	Flexible Purchase Alternative	(cfs)	(%)[2]
Oct	3016	3219	203	6.7
Nov	1980	2190	210	10.6
Dec	3038	3038	0	0.0
Jan	4505	4505	0	0.0
Feb	6392	6392	0	0.0
Mar	6361	6361	0	0.0
Apr	6127	6127	0	0.0
May	5482	5482	0	0.0
Jun	4219	4219	0	0.0
Jul	2314	2314	0	0.0
Aug	1696	1696	0	0.0
Sep	1909	1909	0	0.0

[1] Based on 72 years modeled.
[2] Relative difference of the monthly long-term average.
Note: For a further description of the methodology used for the data assessment, please refer to Section 5.2.1 Assessment Methods.

1.5 References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. *Toxicological profile for boron*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. *Toxicological profile for zinc*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1996a. *Toxicological profile for diazinon*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1996b. *Toxicological profile for selenium*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. *Toxicological profile for chlorpyrifos*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. *Toxicological profile for chlorinated dibenzo-p-dioxins* (CDDs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. *Toxicological profile for mercury*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1999a. *Toxicological profile for cadmium*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. *Toxicological profile for polychlorinated biphenyls* (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002a. *ToxFAQs for Aldrin and Dieldrin*.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002b. *ToxFAQs for Chlordane.*

Agency for Toxic Substances and Disease Registry (ATSDR). 2002c. *ToxFAQs for Endosulfan*.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002d. *ToxFAQs for Heptachlor and Heptachlor Epoxide*.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002e. *ToxFAQs for Hexachlorocyclohexane* (including Lindane).

Agency for Toxic Substances and Disease Registry (ATSDR). 2002f. *ToxFAQs for Toxaphene*.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002g. *Toxicological profile for aldrin and dieldrin*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002h. *Toxicological Profile for Copper* (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002i. *Toxicological Profile for DDT/DDE/DDD* (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002j. *Toxicological Profile for Endrin*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002k. *Toxicological Profile for Chloroform*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002l. *Toxicological Profile for Bromodichloromethane.* Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 2002m. *Toxicological Profile for Bromoform and Chlorodibromomethane*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Ahling, B., A. Lindskog, B. Jansson, and G. Sundstrom. 1977. *Formation of Polychlorinated Dibenzo-p-Dioxins and Dibenzofurans During Combustion of a 2,4,5-T Formulation*. Chemo-sphere 8:461-468.

CNRC (Canadian National Research Council). 1978. *Polychlorinated Biphenyls: Biological Criteria for an Assessment of their Effects on Environmental Quality*. NRCCXNRC, Ottawa. Publ. No. 16077.

Hansch, C., and A.J. Leo. 1981. Log P Software Program for Med-Chem Project, Pomona College, CA.

Harvell, C.D., K. Kim, J.M. Burkholder, R.R. Colwell, P.R. Epstein, D.J. Grimes, E.E. Hoffman, E.K. Lipp, A.D.M.E. Osterhaus, R.M. Overstreet, J.W. Porter, G.W. Hsu, S.T., C.I. Ma, and S.K.H. Hsu. 1985. *Discovery and Epidemiology of PCB Poisoning in Taiwan*. A Four-Year Follow-up. Environ. Health Perspect. 595.

International Occupational Safety and Health Information Center (CIS). 2001. *Ethylene Oxide.*

Knight, I. 1999. *Pathogen Survey for Ships in the Great Lakes Trade*. Paper presented at the Ninth International Zebra Mussel and Aquatic Nuisance Species Conference, Duluth, MN, April 26-29, 1999.

Kuratsune, M., T. Yoshimara, J. Matsuzaka, and A. Yamaguchi. 1972. *Epidemiological Study on Yusho; a Poisoning Caused by Ingestion of Rice Oil Contaminated with a Commercial Brand of Polychlorinated Biphenyls*. Environ. Health Perspect 1: 119-128.

Kuratsune, M. 1975. *National Conference on Polychlorinated Biphenyls*. Chicago, November 19-2 1, 1975. EPA 560/6-75-004.

Kuratsune, M. 1980. *Halogenated Biphenyls, Terphenyis, Naphthalenes, Dibenzodioxins and Related Products*, ed. R.D. Kimbrough. Elsevier, Amsterdam.

Lu, Y.C., and Y.C. Wu. 1985. *Clinical Findings and Immuniological Abnormalities in Yu-Cheng Patients*. Environ. Health Perspect. 59:17.

Rappe, C., A. Gara, and H.R. Buser. 1978. *Identification of Polychlorinated Dibenzofurans (PCDFs) in Commercial Chlorophenol Formulations*. Chemosphere 7:98 l-99 1.

Rappe, C., H.R. Buser and H-P. Bosshardt. 1979. *Dioxins, Dibenzofurans and Other Polyhalogenated Aromatics: Production, Use, Formation, and Destruction*. Ann. N.Y. Acad. Sci. 320:1-18.

Urabe, H., and M. Asahi. 1985. *Past and Present Dermatological Status of Yusho Patients*. Environ. Health Perspect. 59:11.

United States Environmental Protection Agency (EPA). 1980a. *Ambient Water Quality Criteria for Arsenic.* Available from: http://epa.gov/waterscience/pc/ambientwqc.

United States Environmental Protection Agency (EPA). 1980b. *Ambient Water Quality Criteria for Benzene.* Available from: http://epa.gov/waterscience/pc/ambientwqc.

United States Environmental Protection Agency (EPA). 1980c. *Ambient Water Quality Criteria for Chromium.* Available from: http://epa.gov/waterscience/pc/ambientwqc.

United States Environmental Protection Agency (EPA). 1980d. *Ambient Water Quality Criteria for Naphthalene.* Available from: http://epa.gov/waterscience/pc/ambientwqc.

United States Environmental Protection Agency (EPA). 1986a. *Ambient Water Quality Criteria for Chlorpyrifos – 1986.* Available from: http://epa.gov/waterscience/pc/ambientwqc.

United States Environmental Protection Agency (EPA). 1986b. *Health Assessment Document for Polychlorinated Dibenzofurans*. Review Draft.

Villanueva. E.C., R.W. Jennings, V.W. Burse, and R.D. Kimbrough. 1974. *Evidence of Chlorodibenzo-p-dioxin and Chlorodibenzofuran in Hexachlorobenzene*. J. Agric. Food Chem. 22(5):916-917. c-24

Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips and E. Losos. 1998. *Quantifying threats to imperiled species in the United States: Assessing the relative importance of habitat destruction, alien species, pollution, overexploitation, and disease*. BioScience 48: 607-615.

Personal Communication

Richard, Nancy. November 2002. SWRCB. Phone call to Meryka Atherstone, SWRI. Sacramento, California.